

Second Draft  
Comments are invited

## **Organizing and Managing the Poor Client Oriented Research System : Can tail wag the dog?**

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# **Organising and Managing the Poor Client Responsive Research System : Can Tail Wag the Dog?**

## Introduction

Why should natural scientists listen to the farmers at all, much less to the disadvantaged poor ones? Have not they delivered the goods so far so long? After all if they could succeed with dwarf wheat and rice would they not succeed with rainfed millets, oilseeds, pulses, lowland paddy etc. too? If they could produce cross bred cows, improved sheep and poultry, why should they not be able to develop improved draft animal and traction equipment for arid or humid tropics or hill areas too?

These are genuine questions and are not totally without any basis. While we revert to these questions in greater detail in third part of the paper we must clarify why some of these questions have persisted despite substantive research on the logic of farmers' practices in risky ecological contexts. In the process we want to define the context in which demand for poor client responsive research is being made.

Part of the scientific dogma emerges from the learning of wrong lessons from the earlier success. But part of it is also related to the loose use of terms by those who argue about incorporation of poor farmers' interests in formal research.

We want to demystify the magic phrase that by responding to 'farmers' goals and constraints' more liberating alternatives will emerge for the poor.

### **The Paradox of demand and unfelt needs**

How do farmers' determine their goals?

Just like in any demand based theory, the process of demand realization, articulation, and preference ordering must be clearly conceptualised while invoking

farmers' participation. The poor households, particularly in vulnerable ecological regions having suffered economic, political and institutional deprivations for centuries learn to adjust. They not only develop risk adjustment strategies in the field of resource management but also in the field of social exchange relations. Some of these adjustments over time become adaptations. Implication is that they do not feel many of the needs which they have and we think they have. Obviously since they do not feel these needs they do not articulate them.

Demand is thus limited by the historical availability and expectation of supply. It has now been accepted by many critical social analysts<sup>1</sup> that "individual preferences are not given. They are shaped by history, culture, social back ground" among other variables (Mc Pherson S 1983). Sen (1980) went a step further and argued that the way we describe a social phenomena including the demand for research will determine the way we use our knowledge for predictive or prescriptive purposes affecting in turn the choice of methods used for social change.

Every adaptation to environmental contingencies reduces at least one need based stimulus from the repertoire of farmers' choices or dilemma progressively, over time what the poor demand can thus not be considered a comprehensive basis of what needed to be supplied.

Likewise, the lack of demand cannot absolve the managers (that is the scientists) of the supply system of the responsibility they have for:

a) recognizing the historically of demand articulation:

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<sup>1</sup> Michael S McPherson 1983, Want formation, Morality and some "Interpretive" aspects of Moral Enquiry, in Social Sciences and Moral Enquiry, Ed. N. Haan, R N Ballah, P. Robinow and W M Sullivan, Columbia Univ. Press. 97-124.

Amartya Sen 1980, Description as a choice, Oxford Economic Papers, 32(3) 353-369.

- b) generating demands which given the state of art of natural science knowledge can be conceived as reasonable and ecologically sustainable;
- c) organizing supply of alternatives which could be built upon the existing knowledge base of the households and at the same time extending their horizon of future needs, choices and demands.

Once it is understood that the methods have to be developed not - merely to document the articulated demand of the poor farmers but also to generate it, the situation becomes far more complex and challenging. The requirements of the organizational context in which such a behaviour will be called as legitimate, scientific, and desirable have to be properly conceptualised.

The contradictions which will ensure when some scientists will work on the problems that generate immediate pay off for the better endowed farmers while others work for the poor ones have to be anticipated.

In this paper we attempt to put the issue of farmers' participation in formal agricultural research in socio-ecological as well as institutional context.

We argue that while forging new links (between scientists and the poor farmers) the older links (between rich farmers, agribusiness, multinational biotechnology and agro-mechanical - chemical firms, and the scientists) have to be loosened.

We also submit that while most technologies are eco specific, only some are class specific though every technology is rooted in the historical and social context where it evolved. Thus the need for working with poor need not be emphasized merely because different technologies have to be developed, but also because this interface will generate the necessary empathy towards poor and their knowledge system. The need for generating new demands as well as need for identifying new relationships between

innovation for survival vis-a-vis innovation for surplus accumulation further underlines the importance for closer dialogue between what Biggs calls informal and formal R&D. The Indigenous or Local Technological knowledge (ITK) and plea for incorporating it in formal science have been made in India for a very long time. There was a meeting on indigenous veterinary medicine in 1950s in Mathura, UP and Post Graduate research in 1960s (Singh and Verma 1967). More on it later.

One implication of research with marginal farmers is the marginalization of the researcher himself/herself. In our paper we urge the concerned scholars to note that since in near future not all or not even the majority of the scientists will like to work with the poor farmers or become accountable to them, the dynamics of minority action needs to be well understood. The `developmental Deviants` or `Organizational insurgents`, as we call these minority of the professionals, have to be sustained in the short run, if better and more liberating alternatives have to emerge in the long run.

In any research framework if we ignore these issues and use a partial analysis we will end up only marginalising the research with the poor farmers.

We have demonstrated elsewhere that poor are even more efficient in managing certain labour responsive enterprises (like sheep and goat management besides mixed cropping) and thus can help the scientists learn some new rules of sustainable resource management (Gupta, 1981, 1984).

#### Organization of Paper

The paper is organized in six parts

Conceptual framework underlying socio-ecological framework and its organizational imperatives is discussed in part one.

Brief literature review on the context of science, its role in producing usable knowledge, influence of different client groups on the choice of research agenda, organizational implications of research for uncertain environments, communication - formal and informal and its bearing on structure of research systems etc; is given in part two.

In part three the issue of why alternative research system or organizational design when the same system has delivered results for so long is discussed. The implications of 4-S and 3-A models are drawn while discussing some of the institutional imperatives. The case is made for research on peasant innovations which was started several decades ago in India but not continued the way it should have.

The fourth part deals with the organizational and managerial issues. Several theorems on monitoring are stated and illustrated. The key thrust is to argue that monitoring generates design.

The issues relating to the dynamics of research on marginal farmers and marginalization of the researcher are discussed in part five. The concept of creative deviance is discussed in context of organizational requirements of standardised information processing systems.

The part six includes description of certain methodologies of involving farmers in the on farm research in high risk environments.

The conclusions are given in the end. Three of the methodologies viz: ecological mapping, manual discriminant analysis and interactive, iterative and conflictive process of case study are described in greater detail in the appendix.

## Part One

Responding to poor farmers' needs (felt and unfelt) in Risky Ecological Contexts : Socio Ecological Paradigm.

### Conceptual Framework

There are several features of risky ecological context such as rainfed, humid and arid tropics which need to be properly analysed (Gupta 1981, 1984, 1985, Jodha, 1978, 1985; Spitz 1979; Richards, 1985).

- a) The population density in arid tropics is low though it varies in humid tropics from very high (Eastern India, Bangladesh) to quite low in certain parts of south-east humid tropics;
- b) The infrastructure (both public and private) is quite weak, market forces are subdued or underdeveloped;
- c) Out migration seasonal or permanent is quite high;
- d) Diversification of occupational matrix is very high, the farming systems are complex and require simultaneous study of crop-livestock-tree-craft-labour interactions;
- e) The kinship and extended family systems are strong, informal cooperation is high;
- f) The reliance on common property resources is high (be it common grazing land, low lying water bodies for fishing, common forests, mines etc.)
- g) Ecological endowments vary a great deal at short distance due to erratic rainfall distribution, flooding pattern, undulated topography, drainage characteristics etc.

### 4-S Model

The space-season-sector-social stratification matrix of 4-S model helps in recognising these relationships at macro-level (see figure one).

The logic of the way spatial characteristics in conjunction with seasonal and sectoral parameters shape social relations of exchange helps us in understanding the evolution of peasant knowledge base and institutional processes (i.e. rules about rule making) sustaining this knowledge base or weakening it.

### 3-A Model

The household choices given in above macro framework can be seen with the help of a simple 3-A model.

The access to resources, information, markets; and assurances available from institutions to deal with risks individually or collectively influence the abilities (skills) which are required or which will survive to convert access to investments.

The Ecology, Institutions and technology thus exemplify the three coordinates of human choices i.e. Access, Assurances and the ability. The conceptual framework reviewed by Farrington and Margin (1987) misses the implication of 3-A model for scientists - farmer interactions. If the assurances from market as well as public institution are weak (as they are in case of price, procurement and storage of millets, pulses, oilseeds, custom hiring of farm equipments, public distribution system for fodder and food, emergency supply of good seeds, inventory of farm chemical and fertilizers at local level etc), the signals which poor farmers would provide to scientists about what innovation need be explored or tried (if available) would be very different than otherwise. Further, it is not surprising that while poor people could manage several common property institutions for so long, the international centres of agricultural research (like ICRISAT) gave up group based approach implied in the water shed basis too soon considering it not feasible. Most other technological choices are conceived at individual

level

even

for

problems which are inherently common property or poor oriented (such as drainage, crop pests and diseases etc.).

The research on generating institutional assurances which widen the horizon of the poor household as well as elongate the time frame in which they appraise their choices is sine qua non of a truly client responsive research for poor in risk, ecological context.

The risk reduction and not surplus accumulation seem to characterize many of the innovations at the farm of poorer households.

#### Socio-Ecological Paradigm (See figure 2)

The complex relationship between ecological conditions and economic parameters has to be adequately understood to appreciate the theoretical basis of the methods proposed in this paper.

The main assumption of this paradigm are:

- a) The ecological conditions (complex of edaphic and climatic factors) define the range of economic enterprises which can be sustained in a given region.
- b) The scale, however, of each of the enterprises depends upon the access of the households to factor (land, labour, capital, sometime interlocked. Considerable work on the latter aspect has shown that in the Eastern India as well as in the parts of Bangladesh, the interlocking of the factor and product markets may bound the rational choices.

The portfolio of the enterprises could have characteristics ranging from low-mean low variance in productivity and income to low mean-high variance, high mean-low variance and high mean-high variance. It is also possible that the mean and variance in one enterprise may co-vary with the mean variance of other enterprise. For instance the

intercrop combination has essentially evolved to reduce the negative variance through the assumption of contravariance between the crops. If one crop fails other may succeed. This could be worked out not merely at a time but also over time, for instance, through relay cropping. The excellent example of this type of technology is wheat relayed in Aman Paddy Crop in North-West Bangladesh. The pockets where this technology was evolved are highly localised and even though the innovation was attempted by few farmers it has diffused over the part largely because of the ecological feasibility and the economic characteristic of reduced risk. Agro-forestry, mixed fish species in tanks etc. are other examples.

It is obvious that the types of fish which will be collected or the type of livestock specie which will be maintained is not independent of the time frame in which one would manage an individual or common property resource. In the event of disaster like drought or floods the choices may also depend upon ability to borrow with or without interest, raw information) and product (technology, crop, livestock) markets, mean variance inherent in the existing enterprise mix, access to public, private, communal and intra as well as inter household risk adjustment (HHRAs), extended family system etc. As show in the figure 2 the dynamic interplay between technology generation and diffusion vis-a-vis the ecological and economic forces can be understood as under. The enterprise mix implies crop, livestock, tree, craft, labour etc. I different ecological regions the ratio of different species varies within a close range. For instance the pocket where sheep to cattle ration is high vis-a-vis the one where it is low is expected to have very different ecological characteristics than the other one. Likewise the ratio of different tree species and of course crop species also gets modified considerably by the antecedent, edaphic

and climatic factors amongst other ecological variables. The Ecological mapping as a method proposed in this paper takes care of these aspects of the paradigm. The niches so identified are helpful in generating priorities. The conceptual basis of the method used by IRRI and CIMMYT in terms of recommendation domain of a technology developed at site is inadequate. The approach has to be from the command area to the catchment area rather than the vice-versa, if catchment area is the site of the trial and the command area is the extrapolation area of the technology. Given the mix of the enterprises in a region which is essentially an aggregation of individual choices one has to understand and discover the basis of individual choices. The access to the factor and product markets may sometime be independent and material, seeds, equipments, boat etc. from formal or informal sources. The access to extended family systems and kinship network play an important role in risky ecological regions where these are the strongest.

The public or private relief mechanism in the post-drought or flood period, communal risk adjustment and intra and inter HHRA further modified the time frame and discount rates. One would therefore, observe that the same household may use a very long time frame while planting trees and choose a very short time frame while planting crops. As said earlier the response to risk is not uniform across the resource markets because of the reasons mentioned above. Final outcome of so derived time frame and discount rate could be deficit, subsistence or surplus household budgets. This modifies the choice and growth rate of enterprises in the household portfolio which in turn has a feedback on the ecological systems. The identification of individual innovations by different classes of farmers becomes theoretically understandable in above context

because of the recognition of the forces which impel a decision maker to innovate. MDA is a method to particularly help in this process.

## Part Two

LITERATURE REVIEW : Client responsive research, organizations and the processes

We intend to trace the issue of social inquiry, marginal people and the institutional context of researcher in a manner that the propositions put forward in the later chapters can be substituted in the proper context.

### **Scientific Knowledge and its Relevance**

Jacob notes in context of the importance that prior theory has in any investigation, “those who see God, find him, said Pascal - but they find only the God they are looking for”. It is obvious that theoretical context in which scientist, his work environment and the various client groups are seen to be related will influence the relationships that are studied for eventual manipulation within and outside the research organizations. Scientists may sometime seek problems that are not only solvable but also worth-solving (Wildavsky, 1979). What determines the worth of a problem to be solved can be seen through three types of tensions mentioned in this regard: (a) thought and action, (b) dogma and scepticism and (c) resources and objectives. The first tension implies interplay between planning and politics, i.e. how do we conceptualise research agenda and how actually it is carried out. The second tension implies conflict between what we believe and what we doubt. In the evolutionary perspective of scientific knowledge individual scientists try to build new concepts or alternatives brick by brick. Problem arises when certain bricks do not match with other bricks. Whether the overall design of the structure is kept constant so that only bricks which match are selected or the

structure itself is modified is the issue. This obviously would be a function of the capacity of the structure to permit and generate doubt. The third tension relates to essentially a visible criterion for desirable concerns, i.e. what we want tempered by what we think we can have. In the organizational context the key to strategy is considered to be the context. Most important discoveries were made when context of earlier known relationships was transformed by a new equation, for example, by Einstein in case of matter and energy. The context often defines the content of enquiries, of structures and processes in organizations (Gupta, 1984).

### **Producing Usable Knowledge**

The controversy about the basic and applied science, the status of the researchers engaged in these type of activities and the esteem that is granted by the peers vis-a-vis by the policy makers has been as old as perhaps the formalization of science itself. There are some who believe in what could be called as Godel's theorem of science implying that scientific activity can be pursued only in an unscientific context.

Recalling the views of a very senior scientist, who headed one of the first industrial research laboratory of the country, a colleague observed "some how he (the service scientist) felt that the world of pure science with the paper as its basic product, and its system of peer group evaluation was a safer and sounder one. It was more predictable than consumer or press reaction" (Ramamurthy, 1975 quoted in Viswanathan, 1985; 153 emphasis mine). This indicates one of the perpetual tensions in the scientific community. Producing for profession vis-a-vis producing for people and that too with no power to promote or reward is a dilemma that often is resolved in the corridors of research establishments rather than across the countries. As Paquet argues the optimal

amount of coercion is not zero. If we believe that the contract between the scientists and their primary constituency needs to be consistently appraised then arena for this appraisal has to be provided (Paquet, 1984). The conflict between serendipity (chance discoveries) and accountability (planned success or failure) has to be faced head on.

If we grant that in a decision situation some of the variables which influence the outcome are the number of alternatives considered and the possibility for concerned parties to voice their position (Va ri Anna and Veeseanyi, 1984), the study of these interests becomes central to the study of organizations. The same concern has been expressed by some other organizational scientists too (Zey-Ferrell, 1981).

One of the concerns in science management is to study the transition from discovery of knowledge to pursuit of control. It has been suggested that, “as science moves from knowledge to control, it creates what it knows” (Furnham and Lewis, 1986 : 12). The implication is that certain alternatives are pursued and therefore, involvement of scientists in such pursuits becomes legitimate. At the same time other alternatives are abhorred.

How stubbornly a system sticks to the existing approach determines how adaptive it could be given social and environmental uncertainties. Analogically the conflict has been suggested as TOTE approach implying a choice between test-operate-test-exit and test and exit if successful - try some other operation (Andrew, 1980 : 25). The pursuit of plurality therefore, has to be matched with organizational structures and process that not only permit, but in fact allow conflicts between conflicting perspectives to, be resolved professionally. It is obvious that certain ways of resolving conflicts are more professional than others.

## **Relevance in Agricultural Research**

The problem of relevance has been pursued in all the societies be they the developed or less developed. It has been suggested that,

“a science preoccupied with being useful may fail to notice the broader, secondary implications of the product, while researchers who relate closely to a particular set of users may find themselves avoiding research questions or soft pedalling findings that would embarrass or disadvantage those users. Such researchers may even press the institution to stifle research by scholars in other fields which are unfavourable to its clients’ interest and to the extent they succeed, the scientific institution becomes incongruously, a censor”.

“.....Researchers have worked with the efficient, better endowed farmer - not the “disadvantaged” ones. They have worked with managers, not workers, and they have tended to share the managerial view that labour union hinder, “efficient resource utilization” a view which provides yet another incentive for reducing the amount of labour in agriculture” (Hadwiger, 1982).

It is not without significance that one reason advanced for the lack of break through in Dry Farming Research has been the expectation of scientists and public policy makers to have widely applicable technologies (Gupta, Patel and Shah, 1987). The alternatives which may have localised applicability get neglected. Scientists in that sense are the true futurists. They do not merely anticipate the future, they in fact shape it (also see, Latour, 1983, Hadwiger, 1982).

The scientific rationality of mean and ends, Lacy and Bush (1983) believe, explains the excessive reliance on means (the instrumental or tool view) rather than on the ends of research. Even in U.S., the “common farmers, themselves unencumbered by the book learning, were not able to imagine that science could help them (and indeed throughout the nineteenth century it offered little help)” (Hadwiger 1982 : 19). Only later in twentieth century, two types of clients emerged, one who had interest in the production of particular commodities and second, Farm Bureau professionals (including extension worker). The commodity scientists tried to draw strength from community producers by co-opting them on their departmental and project advisory committees. These tie-ups have been known to `distort` the research resource allocations.

In Sudanese context, it has been shown that problem-solving was not the most important focus of research designs. The client influence were thus manifested in form of negotiated agreements (Bush and Lacy, 1983).

The debate on the possibility of class bias in generation of technology has been quite muddled. Those who have argued for it have generally failed to give precise alternatives. Those who deny the possibility of such a bias have been far more emphatic (Rutton, 1982). Many believe that improving access to institutions is more important than generating different technologies for rich and the poor (Binswanger, 1979, Ryan 1985). At ICRISAT, the scale-negative technologies were found to be elusive. Rutton had conceded the possibility of class bias only by way of commodity choice (i.e. more work on those crops or enterprises which characterize the enterprise mix of poorer households). In a review of resource allocation for Dry farming Jodha discovered a bias against many of the rainfed crops (Jodha 1984). He also noticed that results of those trials in which no output was received were often excluded while working out the trend yields. The horticultural and plantation crops were reported to have received far too much research resources in terms of grants from ICAR in 1981-82. The resources for paddy and some other crops in contrast were quite meagre (Mukhopadhyay, 1983).

Management literature is quite rich on organization-environment interaction. The role of ecological variables in organizational behavioural literature, however, has remained neglected (Gupta, 1986 a,b). Likewise, considerable work has been done on the customer-orientation of the organisations. Different clients in the organizational environment and varying attention.

Some of the hypotheses advanced in this light are: (a) high customer contact enriches the content of the job; (b) high contact requires higher interpersonal skills; (c) low contact is compatible with programmed decision making culture endowed with higher certainty; (d) higher contact is enabled by closer location of services; (e) higher contact required analogic communication rather than digital one (Chase and Jansik, 1983). The analogic communication referred to non-verbal, symbolic forms while digital referred to complex, logical syntax of communication.

There are other studies which show that those employees who come in direct contact with customers for two or often than others (say, the counter clerks in case of bank branches) generally argued with their bosses on behalf of clients. Instead of explaining the organizational position to the clients on a particular issue, they advocated clients position. Such a role reversal has interesting implications for patterning organizational structures. Perhaps Chinese efforts of compulsive field work during cultural revolution by even senior scientists and professionals may have contributed in generating greater empathy. This concern has also been expressed in public administration literature. The managers are supposed to synthesize, summarize and articulate the preferences, feelings or mood or citizenry. Since public administrators know how the government works, the suggestion is to free them from preoccupation with organizational maintenance functions and instead concentrate on finding out liberating alternatives (Frederickson, 1982). The literature on Strategic Management research uses the common sensical metaphor of “putting yourself in others’ shoe” to generate concern for bringing others’ point of view on the agenda. It has been suggested that transition from corporate social responsibility to

response may reflect the weakness of the concern for clients' (Gilbert and Freeman, 1985).

The essential task is to classify or develop a taxonomy of interaction between clients and different forms of research organizations. Lack of such classification capability is said to be one of the major weakness of contemporary organizational theory (Engwall, 1982). To elucidate this aspect, we can compare our experience in different libraries. For instance, the library of IDS, Sussex follows a authorwise stacking of documents and books. The library at IIM-A and many other places follow Dewey's classification and also subjectwise stacking. In the first case, one cannot browse through the racks to not merely look for the needed reference but even some related ones. This is possible in second case.

In first case, one has to go by the subject index and look for authors and search the books there. The point is that same information i.e. books classified by different rules creates problems of both access and commulation (i.e. building upon one's previous knowledge). The classification of different interactions therefore according to some common rules will expedite the theory building process. It will also help in developing operational alternatives because the typologies will also be fewer than the total realm or the possibilities of interactions.

### **Scientists' response to uncertainty**

This is one of the most important issue for OFCOR scientists because the need for client orientation is highest in uncertain environmental situations.

Studies of sociology of science have shown that "predictability of consequence is, much more powerful criterion for choosing an action rather than their relative 'utility' or

`morality' (Zelery, 1985, 314)". The scientists working on problems of high certainty, greater visibility of consequences and in fields with highly developed paradigm could acquire resources easily. UNESCO sponsored study on the Organization and Performance of Research Units for the highlighted that the scientists gave for more emphasis on measurability, reliability and validity with little or no consideration for the manipulability of the variables. Three reasons were advanced for such a behaviour : relevance, applicability and specificity. It was felt that the "scientists, however, try to develop theories and contracts that are applicable across a wider range of situations. This increases the abstractness of research findings" and there the practitioners have difficulty in translating such findings into utilizable knowledge (Cheng and Mc Kinley, 1983).

Another implication of increased uncertainty on account of less developed paradigm (i.e. lack of consensus on key questions as also the key variables and the methods of measuring these variables) is the requirement of increased information processing capacity. Any effort to restrict the ability of researchers to pursue alternative or multiple strategies in such a context may increase the probability of their (the researchers') pursuing unproductivity line of enquiry (Cheng and McKinley, 1985). It is useful to recall the suggestion made in a study to review Indian agricultural research strategy. It was mentioned that organizational innovation of starting All India Co-ordinated Research Projects and gradually expanding it has a tendency to leave very few resources for individual research projects. Caution in this regard was advised by National Commission on Agriculture in India, 1972.

Recently, in a study we have argued for a need to provide higher resources for "deviant research" or innovative research by younger scientists. In case of dryland

project, the environmental uncertainty necessitates a loosely-coupled network form of organization rather than a tightly inter-woven structure (Gupta, Patel and Shah, 1987).

Finally, it has to be recognized that “public policy makers want as little uncertainty as possible and place demands on the scientific community to deliver certainty or facts” (Joanne, 1984). While we do not agree with the views which would liberate scientists from any direct social responsibility what so ever (Rutton, 1982); we do recognize the need for more careful analysis of scientific processes. Under certain i.e. low risk environmental conditions, the tendency to replicate laboratory out in the field (Latour 1983), did produce results. Scientists did not to have go out to seek agenda or involve farmer in research process. The conditions at farmer level did not vary much. There existed large tracts of environments which paralleled the conditions at research farm.

However, the transition from ‘ought’ to ‘is’ intermediated by the values which guide the actions of the scientists.

### **Values, Culture and Belief Systems**

In a study on performance of research units and pattern of influences, scientists were found not to perform best when left alone. Some frame of reference was inevitable (Kowalewska, 1979). The questions about the process of decision making and the implicit values are not raised when correctness of the outcome is undisputed. But the values of researcher acquire importance when outcomes are uncertain and no definite criteria exist for evaluating the rightness of the outcomes.

Numerical empirical studies have shown that managers, “who know that they will be evaluated by outcome, rather than by process, may be reluctant to expose themselves to high risk undertakings (Williamson, 1975 in Majone, 1979).

Out of the most challenging tasks confronting the research managers is to develop ways of monitoring and evaluating inputs as well as through put when outputs are uncertain (as in case rainfed research). As Simon has put it, the substantive instead of procedural rationality has to guide the judgement of organizational designers. The Weberian model of structuring roles and outcomes in any organization may only keep in achieving procedural rationality. The high divergence of outputs of different scientists makes systems suited to deal with standardised outputs highly inappropriate.

In a study based on interview with Sorghum scientists, it was discovered that germplasm bank of Sorghum, at ICRISAT contained information on several parameters but no data on storability, food quality, cropping practices and ethnic group (from where the seeds were collected) (Busch and Lacy, 1984). The judgements like these are guided by the value scientists or college of scientists place on certain attributes of a crop or enterprise. This cannot be analysed within the realm of scientific enquiry. Extra-scientific variables have to be brought into picture.

Cultural context or macro-economic and social environment also influences the value judgements of the scientists (Frey, Pommenehne, Schneider and Gie best, 1984).

The subjective estimates do not always correspond with the objective reality. The historical context in which certain values have evolved may make the effectiveness of research unit `independent of the correspondence between subjective perception regarding external resources and actual resource levels’ (Stolte - Heis Kanen, 1979).

## **Communication, Inter-organization networking and Power**

Studies on communication amongst the scientists have shown that, “whatever the rational and the institutional/scientific settings; both between - units communication proved to have a strong relationship with the recognition of units, their R&D effectiveness, their number of publications or written reports and their application effectiveness (Visart, 1979) good communication within units seemed to be even more important than communication between units.

We however, suspect that if research units are located wide apart in remote areas with harsh living conditions (as is the case in dry regions), the inter-unit communication may become more important. In a study based on dryland scientists we recently found that arrangements for inter-unit (i.e. dryfarming research centres) communications were highly inadequate (Gupta, Patel and Shah, 1987). Linked to communication is the issue of inter-organization exchange of information, resources and of course power. Studies on Transaction Costs (T.C) have brought the issue of inter-organizational exchange into sharper focus. The transaction costs are defined as “the costs of establishing, maintaining and terminating a transaction - above and beyond the costs of simply producing a good or service” (Bryson, 1984).

It has been found that as the uncertainty increases ther T.C. increases; higher the frequency of transaction and longer time frame in which transactions are made, greater is the need for and reliance on trust; and higher the investment specificity in transaction, higher is the T.C. It follows that when trust is low, the T.Cs are higher.

Organizational scientists have tried to relate the forms of organizations with the degree of trust and implicit T.C. Several strategies have been proposed to explain inter-

organisational interaction. Benson (1978) suggested four strategies viz, co-operative, disruptive, manipulative and authoritative. We have argued that several of these strategies could be simultaneously involved and this may not be tried exclusively (Gupta, 1986). The exchange between research universities/institutes, extension department, district or state departments of agriculture, irrigation, power or even revenue administration, banks etc. need to be conceptualised appropriately so that linkages supportive of OFCOR can not only be forged but strategies for counteracting dysfunctional linkages can be developed.

A dilemma raised with regard to exchange of resources amongst different organizations still remain unresolved. How do we develop a calculus whereby equivalencies between different type of resources and amongst different networks was established (Benson, 1981).

One of the frequently observed implication of the above dilemma is the claims and counter claim for recognition as well as responsibility (or lack of it) for varying performance of agricultural programmes in the field. The statements like, “technology exists but extension system doesn’t make enough effort or banks do not provide sufficient credit, or government does not provide adequate price or procurement support” are not uncommon. May be, there is indeed some validity in such statements. But how does a scientist derive meaning out of such intersecting and fuzzy sets that evolve in a varying manner over time.

Scientists face a challenge of not merely identifying future institutional and inter-organizational environments but also develop research programme aimed at generating relevant, useful applicable alternatives.

The degree of overlap of various exchange networks in a community may sometimes be an “important determinant of the level of potential inter-organizational activation to meet a community crisis for emergent needs” (Cook, 1977).

The key issues thus are, how do the managers and designers of organizations generate signals which

- a) do not legitimise a rationality which rules out certain behaviour (Bryson, 1984);
- b) invoke co-operations among disciplines, departments, levels and skills but prevent formation of an early consensus which invalidates plurality in research pursuits;
- c) provide ways to maintain esteem and pride even if tangible outputs of research elude despite `logical` and `rational` research resource allocation;
- d) allow unscientific contexts (value, politics, biases) to interact with scientific instruments and framework explicitly in pursuit of interests of different clients; and
- e) prevent marginalization of researcher who choose to (or are forced to) work on the problems which mainstream scientists have either not pursued or abandoned or neglected or even failed to pursue hard enough.

The researcher always serves the interests of some clients. In a market framework, it is well known that only certain type of demands are articulated in a manner that markets can monitor. The rest of the needs have to graduate into demands followed by organization of supply of alternatives. This paper is an effort to open this black box of `unscientific` context of `scientific` pursuits.

### Part-three

Many agricultural scientists mock at the attempt to raise the issue of learning from the poor farmers in context of the setting up formal research agenda. Their views could be summed up as:

- a) If the farmers were so adept at dealing with the environment and using resources why would they be so poor or have so low factor productivity? (Some might even suggest that perhaps the traditional technologies were suited best for subsistence ethic whereas the surplus oriented ethic required different selection criteria. By the same token if the so called traditional farmers appraised their choices in far longer time frame than their 'modern' counterparts the choices earlier could be even more environmentally suitable or the technologies may be more sustainable).
- b) What role can farmers play in setting the research agenda? After all no farmer demanded the dwarf wheat varieties with high input response. It was a supply side intervention without any involvement of rich or the poor farmers of South Asia in generation of technology. The factor supplies also did not change in any significant manner i.e. the capital did not become abundant vis-a-vis labour so as to generate the signal that capital intensive technology should have been innovated.
- c) When farmers cannot even read or write will they be able to give us all the data we need to verify the utility or otherwise of their practices?
- d) Have not we delivered the results for so long without any explicit farmer involvement? Why make so much fuss about farmers' involvement and

- e) Do not we involve farmers already in varietal testing process? What more can be expected from the overworked scientists?
- f) Do not we recommend varieties after taking into account the problems of different regions and farmers?
- g) Is it possible to contact each and every farmer in a large country like ours to understand their problem? What should be the role of government agencies like extension and agricultural departments? Should not they contact the farmers and communicate the same to us? Should the scientist be expected to develop technologies which can withstand floods, droughts, give high yield when weather is good and so on? Is not the final performance a result of combined effort of many agencies?

These questions are of different type and emerge from different persuasions. perhaps a brief discussions on these questions is in order before we move on to the descriptions of the ways by which involvement of farmers can lead to pursuit of better and more rigorous science.

## Institutional Imperatives for Research on Peasant Innovation

It is necessary to conceptualise the organizational context in which research on peasant innovation and practices would become a necessary complement of basic and applied on-station research. It has to be recognised that several innovations would continue to come about through entirely or essentially supply side interventions. Just like the discovery of America which was a fluke because the theory or experiment which Columbus was trying to test had failed. There are many examples where even if the main purpose of a research or an experiment has failed the insights in the process of pursuing that experiment have been extremely useful. When does an event become an insight depends considerably upon the theory-in-use on the part of the scientists. Before scientists recognise uniqueness of a farmer's practice they must begin to recognise the anti-thesis of their own research paradigm.

The success is often measured in terms of the diffusion of a particular variety even if it narrows down the genetic. The viability of the poorer households in risky ecological contexts hinges on the other hand on the diversity of the germplasm. This is one of the basic contradictions between the way success is defined in the organization and the outcome it may produce in medium to long term in the region. The next aspect of organizational culture is the recognition that work with farmers would only be as strong or useful as the basic science inputs in interpreting this work. No farmer in south Asia had ever either demanded the dwarf Mexican wheat variety nor had anticipated such a breakthrough, and yet it came about. The scope for supply side interventions, therefore, remains. When breeders make crosses amongst different parents lines in any particular crop, they make several judgements such as (a) what characters need to be combined in a

variety, (b) which parents can contribute these characters at minimum costs (i.e. without simultaneously transferring the linked undesirable genes), (c) whether the important characters are monogenically or polygenically controlled, (d) whether the coefficient of variation arising out of the various disabilities of the new plant is the sufficiently low to pay for the increase in the main yield. In other words the breeders make assumption about the support systems under which a particular crop or variety would be grown.

It is obvious that many of the criterion which breeder uses for selecting various lines in a segregating population are not based on what can be called essentially a scientific formula i.e., two different breeders given the same population and same method may not necessarily make the same selection.

It is here that the work with the farmers can become extremely crucial. The selection criteria, therefore, is a judgement influenced by both the values and the assumptions about the environment of the user which scientists hold valid.

The research on peasant innovation or Practices would also be influenced by the way performance of the scientists is monitored individually as well as collectively. For instance during review of on-farm research in a particular developing country in an Institute (where work had been carried out far more systematically than many other places) it was noted that there werer not many examples which on-station scientists could provide of the trials having been started on the basis of feedback from the farmers or on-farm research.

Conceptually speaking the organizational context in which scientists work has an important bearing on the choices scientists make. While individual incentives and motivations do make a difference, the strategic shift in the approach of agricultural

research systems cannot come about without proper analysis of the monitoring systems of the scientists.

Finally the norms of accountability which exist in the research organization vertically as well as horizontally have an important bearing on the possibility of involving farmers in the formal research. The vertical accountability refers to the one between junior and senior scientists while the horizontal refers to the accountability between scientists and the farmers - rich and the poor.

In our view the methodological approaches become relevant only when the theoretical assumptions underlying these approaches are made explicit.

Other implications for structuring organizations of OFCOR. Conducive to above concerns are the following we have also drawn upon the 4-S and 3-A models described earlier.

Following from the 4-S model, the concern of scientists that enough is already being done more of the same would do the trick in rainfed regions can be empirically disputed.

- a) In the regions where population density is low, seasonality is high and occupationary matrix is diverse, the number of the on-farm trials will have to be obviously more than in the other regions.
- b) The costs of transportation, supervision of trials and organizing logistics will also be higher due to dispersed nature of the trials. By not discriminating in the budget for such research stations/sites, designers and managers of organization not only create moral hazards for the practitioners but also communicate very explicitly their disinterestedness in the high cost - high risk - high effort activities.

c) Given the higher failure rate of the trials, not only compensatory mechanisms for farmers need be worked out but also changes in the evaluation parameters of the scientists are needed. The yield increasing research is reported to attract more attention than the risk reducing research.

Our reaction to some other issues raised in the beginning of this part is given next

i) While it is true that many farmers cannot read just like many of us cannot interpret our pulse rate, heart beat or some environmental signal, it does not imply that the farmers or we cannot communicate our needs in respective areas of concern within limitations of course. There are scientists who cannot feel a soil or interpret humidity in the air or temperature of soil by hand, feet or odour. It does not invalidate the knowledge of the scientists soil structure, texture or physics etc. What follows is the need for building bridges between the two knowledge systems.

ii) It is true that many organizations are involved in the generation of ideas as well as provision of feed back. Studies have shown (Busch and Lacy, 1983, Gupta, Patel and Shah, 1987, Babu, 1984 pc. Vishwanathan, 1985) that several sources of ideas are referred while identifying research problems. In the context of industrial research, it was regretted that scientists working on primary products were hardly accorded recognition. The publications in western journals, peer reviews, prestige attached to techniques/problems, etc. influenced the choice (Vishwanathan, 1985). The annual workshops of the scientists, advice from project director; question raised in Kisan Melas (Farmers' fair) and in the columns of farm journals were some of the other sources mentioned in literature. However, reliance on any secondary source has its own limitations. We have shown through the analyse all the questions which were sent to farm

journal of a North Indian agricultural university that there existed strong biases in favour of certain specific commodities, activities and spaces (regions from where letters were sent to the university. If this articulation is made the basis of designing research agenda, surely the research organizations would be wide off the mark. Likewise, a recent study of all the problems articulated in writing/through petitions to district collector in a drought prone district showed a decisively higher articulation from the well endowed regions but the monsoon season. The scientists thus should not argue that it is the responsibility of other organizations to generate feedback from farmers. It is true that given the enormity of situation, their skills can not be best utilized in just doing the surveys or village studies but at the same time, second hand learning has its own disadvantages.

The poor feedback from extension system in most countries (largely because of T&V system and not inspite of it) does increase the burden of the scientists considerably. Further, our experience is that biological scientists suffer from no particular disadvantage in studying farmers' problems or establishing rapport with them. This is a sad reflection on the state of social science but that is subject for a separate study.

iii) The contribution of the scientists that private sector and other public agencies must be made to bear greater responsibility is quite valid. It is unfortunate but true that in several fields (most notably farm implements/agricultural engineering) the allocation of corporate profits for R&D is negligible. This situation has to be connected through macro-national policies. We can thus see that many apparently skeptical comments of mainstream scientists have lot of validity. What is needed is to modify or transform the context in which these questions or doubts have been raised so that instead of ignoring each other, we start communicating.

### **The scientific assertions and unscientific analysis**

At the outset it must be acknowledged that the question, “whether the indigenous knowledge is still relevant?” is not new. Way back in mid sixties Prof. Y.P. Singh and his students had raised this question in the context of indigenous veterinary medicine.

The skepticism on the part of the scientists has only grown in the meanwhile with the success of wheat and partly rice ‘revolution’ behind them. The argument that the local varieties and agricultural practices are bred for risk minimization and not profit or yield maximization is not tenable in rainfed regions where the same varieties still hold sway. Surely there is something more to it than is apparent from the questions listed earlier. If very high genetic diversity could be maintained through meticulous selection and pure seed maintenance in such regions it could not have been possible through random choice or just some careless selection method. Large number of paddy, oilseed and pulse varieties found in the arid, semi-arid and humid tropics together with an equally large number of management practices signifies existence of a basic experiential knowledge base. It is possible that over time to codify many of these decision rules the rules may have been mutated into rituals and thus may have lost some of their effectiveness. The rules may have been evolved through a process of trial and error. For instance, the decision of not sowing a particular variety of Jute before 13th April (a festival amongst several ethnic/religion groups in South-Asia) may have been evolved after studying relationship between day length (which starts increasing after late March) and the growth pattern of crop. Scientists have confused the logic of this practice. It has been seen that if this crop was sown earlier, it would flower affecting the quality of fibre.

The issue is why the rule (i.e. given the change in day length, growth pattern of the crop changed became ritual (i.e. do not sow and a crop before Baisakhi - April 13). In fact, we have discussed elsewhere that one reason why fairly advanced agricultural practices in South Asia in 18th century compared to European practices did not move further may have been the dominance of Puranic (religious texts invoking symbolic unnatural and natural images of god to convey abstract philosophical concepts, strongly laden with rituals) culture. Just like ayurvedic system of indigenous medicine in which whole body of their patient is treated rather than just the symptom as is the case in allopathic system context. The real challenge therefore is to unravel these rules and incorporate them in the process of developing new technologies. It will also imply that unlike modern technology transfer systems like T&V we will not merely contend ourselves with the transfer of just the practices or the technological decisions but also the decision rules.

Most of the agricultural extension strategies are based upon the assumption that farmers have extraordinarily low information processing capacity: Thus, systems are designed to transfer minimum information. Under T&V system, farmers were assumed to be able to remember information only for a fortnight and that too only about one or two practices.

Our contention is that instead of concentrating upon transforming such fragmented technological information, we should aim at transferring science i.e. decision rules. This will link the indigenous science with the modern one. This will also imply that we will apply the same scientific principle of rejection or acceptance of hypotheses no

matter whether the issue at stake has emerged from historical practices of the peasants or has emerged from some of the physical science concepts.

To return to the questions we referred in the beginning let us admit that not all the objections to farmers' involvement are without significance. For instance it is true that in the absence of information about many of the modern techniques or systems like biotechnologies or international germ plasm banks the farmers just cannot visualize all the possibilities that exist. Therefore they cannot demand some of such technologies which the scientists aware of the need contexts can design or deliver. The traditional scientific approach of drawing the bulls eye around the target implied in the multi location trials of advanced generations will have to continue. The farmers involvement in the development of screening criteria will certainly be in order.

It is also true that many of the traditional techniques were efficient in the given information base. But with the accumulation of new knowledge some of these practices become inefficient at least with certain groups of farmers. E.g. those who can afford weedicides (of course the better endowed farmers) there is no case for them to do so many pre-sowing ploughings as many of them still do in case of wheat crop. However, for the rest it makes sense because notwithstanding the objections of the scientists this practice does help in the weed control. The need for focussing the research towards the interests of poor is highlighted in no other case as much as in the case of research on weed control through herbicides vis-a-vis through non-monetary inputs in rainfed regions where weeds are supposed to be the major competitors of crops for moisture and nutrients.

Not all technologies are class specific though most are eco specific. The scientists are justified in therefore not insisting on the class focus in all the cases. It is a different point that they may have no means or method to find out in which case should they have a class bias towards poor - a point illustrated with the help of new methods in this paper. For instance in humid tropics the seed rate of paddy has to be increased with delay in sowing time no matter who sows it - the large farmer or the poor. The fact remains that the ability of increasing seed rate is not class neutral due to unequal access to factor or product markets. The role of farmers in deciding the research agenda thus has to be defined carefully. Likewise if seed treatment is essential for protecting the crop from some of the seed born diseases or vaccination is necessary for protecting animals from some diseases there is no case for making such research class biased. However, which problems affect the poor most as against the resource rich is an issue that undoubtedly will involve a value judgement. In that sense there are few questions that can ever be class neutral.

The question which is most serious and we hear most often from the senior agricultural research leaders is, “have we not delivered the goods so far using our own methods”?

The implication is that more of the same will do. It was the same misconception which led many research planners to apply Indian wheat and Upland irrigated rice experience in Africa and with not much success. With in India the Oilseed mission makes the same assumption. Again we are not questioning that some of the germ plasm which has been found good for high input environment may also be useful under stress environments. What we are questioning is that given the difference in the survival options

of poor households in rainfed regions vis-a-vis the rich in same or other regions the research approach and agenda cannot be indifferent to these differences.

Those who argue that scientist are like the `golden goose (Ruton, 1982) and thus need not be asked to bear responsibility for the social consequences are obviously misinterpreting the history and not without any ideological bias. The success of wheat and to a limited extent rice has resulted in some conceptual blinkers. Thus the way which enabled the scientists to deliver the goods so far may not necessarily help in future and not only because the context is different, nature is more hostile or the demand for technological change is articulated by the poor rainfed farmers very feebly.

The methods of analyzing the scientific basis of the traditional practices; methods to analyze peasant innovations for survival as against innovations for surplus generation; identifying research needs; institutional norms, organizational design, monitoring system and accountability structures for poor client oriented research etc. call for unmasking the black box that the research system is often assumed to be

## Part Four

### Organizational Design and Dynamics

#### Monitoring Generates Design

Excessive emphasis on techniques and tools in ensuring farmer involvement in generating research agenda can be counter productive. The importance of the organizational variables variables which influence the choice of techniques, process of generating, using and disseminating data, emergence of inter disciplinary terms, the role of power and hierarchy etc. need not be minimised. We mention the key principles below and illustrate their implication for OFCOR (on farm client oriented research) as well as generation of incentives for scientist-farmer interactions).

A. A Change not monitored is a change not desired

What type of changes, results, processes are monitored by the top management in any agricultural university/institutes of research programme has an important bearing on how people perform. For example, should we complain if in the top level research review, it is not enquired as to how many on-station experiments have been started on the basis of

- a) feed back from on-farm research
- b) feed back from extension system
- c) feed back from farmers whom the scientists may have met on their own?

Thus unless Director of research monitors the number of trials modified, started or stopped on the basis of feedback from poor farmers directly or through on-farm research, should we really regret that methods don't serve the purpose.

B. Scientists - FARMER - Extension Linkages

b) While a lot is made of the interaction amongst scientists, farmers and extension workers even under the existing system, concrete questions are neither asked nor answered. Concrete ways to monitor the output of these interactions is to appraise whether (a) the content of experiments (i.e. treatments), (b) sequence or priority and (c) data to be collected have been modified at all. Often one would note that the same draft of the research programme which was prepared before the consultants with farmers or extension workers is sent to final review committee without any change whatsoever. Only case in which such a test can fail is when one could assume that the scientists could anticipate entirely what the farmer's need would be.

The idea above is to demonstrate empirically the impact of farmers' and extension workers' feedback on OFCOR by modifying the original research plan or treatments of the experiment. One of the unambiguous ways to measure the success or failure of OFCOR is to look at the variables on which data is collected by the scientists for OFR (on-farm research). Often one finds the parameters for OFR to be similar to be parameters for OSR (on-station research). When we enquired reasons for this obvious anomaly, some OFR scientists informed that prospects of getting a publication out forced them to do so. They would collect data even on those parameters which were genetically fixed and did not show much interaction with the environment. Apparently publishing results of 'soft' data i.e. farmers' perception and response in 'hard' science journals is not so easy.

Interdisciplinary Research

C) It has to be recognised that notwithstanding the emphasis and rhetoric in support of multi-disciplinary research, the commodity based research would continue. There are different arrangements of organizing research by various commodity groups influenced to a great extent by respective CGIAR institutions (atleast in case of some smaller developing countries).

It is true that in principle, many commodity programmes could be multi-disciplinary in nature but in practice the situation was quite different. The wheat programme in Bangladesh for instance neither had any social scientist nor any agricultural engineer or post-harvest technologist. May be, they did not realize the need. May be the concerned departments served the need of Wheat Research Centre. But the issue is that even if the need existed, it was difficult to envisage a situation where pathologists or entomologist loaned to a commodity programme would like to grow in that programme. The problem arises when the career prospects of such scientists are determined by their bosses of the concerned discipline or department and not commodity programme. The matrix structure has not proved very functional in long term research programme. The matrix structure implies bringing specialists from different line departments under a new functional division or project organization.

There are two issues which need to be monitored.

a) Whether in the commodity research programme planning or review workshops (i) the feedback from scientists working with farmers is sought and (ii) If yes, has it been acted upon.

b) To what extent the reports of social science investigations in these regards have been formally presented to commodity group before publishing or finalising the reports.

The idea of working with farmer would be a distant dream if the studies on farmer's decision making are not even reviewed and assimilated in the biological science research programme planning and vice versa.

D. Mutual Monitoring

- i) Horizontal Accountability between farmers and the scientists cannot exist unless the vertical accountability between junior and the senior scientists exists.
- ii) Unless vertical links are loosened, horizontal links cannot be strengthened (Mathur and Gupta, 1984).

The implications of the first principle is that those who believe that interaction of junior scientists (The scientists posted in the field are generally junior, powerless, the rest manage posting to head quarters)\* with farmers would suffice in terms of changing the research agenda, are truly naive. Any change is a political process and power play can thus not be denied.

What can be done is to create institutional processes (such as joint case studies, trek, consultations with farmers etc.) by which senior scientist recognise the lack of positive correlation between the status and skills of the scientific workers.

The loosening of vertical accountability implies greater emphasis on outcomes rather on outputs and minimum on inputs. The horizontal links would automatically be strengthened once the scientists become accountable to poor farmers and responsive better endowed farmers.

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\* Even though we do not have strong evidence in this regard. But this is borne out by the experience of some of the dry farming research centres where social amenities are very limited.

As mentioned earlier under literature review one reason why scientist may prefer work on basic science issues or applied research but on station is the preference for predictable formal peer review processes.

The OFCOR scientists have to recognize the problem inherent in generating an appropriate peer culture or review processes for OFR. Whose opinion counts is another aspect of it.

We came across an interesting example of very senior scientist who in an interview in India was asked to narrate his most important contribution. He gave reference to some technology which he had developed and which had been adopted by farmers in large area. He was curtly told by the experts on the interview committee, but is it not a job of extension? We are interviewing you for the position of a senior scientist. Where are your publications?

The scientist had pushed technology instead of papers obviously in vain. Recognition from above was not linked with the one from below: How to do we expect the scientist to become a countable to farmers horizontally in absence of the legitimacy of their (the farmers') feedback.

The loosening of vertical links or accountability implies that scientist at middle and lower level use 'double-loop learning' (Argyris, 1982). Any programmed decision making system enforced the bureaucratic tendencies. People are trained to follow. The thermostat is an example of single loop learning. In double loop learning the thermostat, metaphorically speaking, would be able to not only switch on or off but also decide at what temperature to do so. Thus when executives or research managers at lower level are made responsible for outputs and given freedom to recombine various inputs in whatever

proportion, the vertical accountability is said to be loosened. The peer pressure, however, ensures horizontal accountability. The scientists may have to modify the directions given from above so as to be more relevant to people in the field.

### **RISK Absorption by Farmers/Scientists**

e) If no allowance for risk absorption has been made, do not ever expect scientists to work with resource poor farmers. It is one of the most significant lacunae of current research strategy. No matter how many useful methods are developed, the ultimate decision on the part of poor farmers would depend upon the risk that the experiment entails. An explicit provision will have to be made to absorb the risk of failure. AICRPDA, Dr. Sanghi and Colleagues had tried to work out an arrangement under which any loss of output by farmer participating in trials would be the project's responsibility. Farmers would not be under any risk. Dr. Abedinat OFRD, BARI and his colleagues had also developed this system at some of the sites. We have developed an alternative concept as given below:

- i) The farmers should be assured of minimum of average of last 5 years yield or
- ii) The yield expected from the trial plot with existing technology in the current climatic condition should be assessed by a panel of farmers from the same village independently. These estimates can be then be averaged.
- iii) The farmer participating in the trial should be assured of so arrived yield.
- iv) Any loss would be made good by the scientists but the gains by new technology should be shared by the farmers in somepredetermined proportion. At NDUAT, Faizabad, Dr. Maurya asked the farmers to return double the quantity of seed of advanced paddy lines given to them. One could ask upto 50% of the increased

- output (that is total yield minus the yield expected by the panel of farmers with old technology).
- v) This output collected from `successful' farmers could be shared with the farmers who `failed' (nay, whose trials failed. Some factors never fail because they try to learn from failure like any other intelligent human being).
  - vi) The scientists should also be told by their bosses that their evaluation would be made not only in terms of successes they achieved but the way they analysed their failures.
  - f) Monitoring the Failures in Pursuit of Success

It was discovered during a research review at one of the institutes that out of more than 3-400 trial results reported, hardly three or four scientists mentioned about the failed replication.

There were two possibilities:

- a) Either most of the trials were done under such conditions that failure was prevented; or
- b) That the scientists had interpreted the results of only the `successful' replications and ignored or suppressed the failed one.

The case being of a highly risky ecological context, the first possibility (A) was not very likely. Thus, when the issue was raised, many scientists admitted that (B) was the case. As Jodha has shown, this is not peculiar to one or two countries or research situation. Why does it happen. Our hypothesis is that the definition of `success' in research expeditions is highly erroneous. We have not learned much from Columbus's Failure which proved as success in many other ways. (Columbus's calculations about the

circumference of the Earth were money. He could have died on the high sea for want of provision if he had not discovered America by accident.

There are several other reasons why we must learn from the failure as much as from so-called successful replicates.

g) Monitoring the Commodity and Treatmentwise Allocation of Research Resources

Even conservative economists like Rutton (1982) concede that only way (in their view) the class focus could be brought into the research programme planning was by concentrating on those commodities which engaged the poorer households more than the rest. He had given an example of beans and cattle trade-off in Latin America.

The research on fattening of cattle was supposed to benefit the better of people whereas the beans as a crop was cultivated by majority of the poor. Likewise mixed cropping within a region is found far more on the holding of poorer farmers. Another exemplar is of inferior millets which were generally grown by rainfed resource poor farmers except in the ecological regions where everybody was constrained to grow the same factors. Some community sometime could be class specific in one eco context and only eco-specific in another context. The example of sweet potato in Bangladesh illustrates this point quite graphically. On Charlands (riverine lands) this crop was grown by all the farmers bigger or small. On highlands this enterprise was restricted to the landless tenants and marginal farmers. The nursery of sweet potato would invariably be found only on the households of extremely poor farmers. The fact that this was used as a source of staple food by the poor particularly for children future emphasized the class focus.

The methodological implication is that the data should be collected on number of experiments on each location for each community and the respective treatments. Such a

table was prepared in Bangladesh for a particular division (OFRD) to identify the thrust of experiments. It was quite obvious that many communities which engaged large number of poor households in risky ecological context did not occupy much weight in the research programme. Further, the number of experiments on fertilizer, pesticides, irrigation etc. far exceeded the number on other practices. The experiments on indigenous practices were negligible.

Unless such a data is monitored a premium cannot be put on the efforts of those scientists who are trying to shift the focus towards indigenous knowledge and farmer's innovations. Another example is of a wheat research programme which was reviewed by the author as a part of CGIAR impact study programme. Whereas 2/3rd area in Bangladesh is under rainfed wheat. Only 1/3rd experiments were found to be pursued for the purpose.

h) Monitoring the Citation Behaviour : An Acknowledgement Culture in the Research Publications

This could become one of the most serious sources of conflict and tension in the research programme. While it is younger scientists who interact with the farmers and generate insights it is obvious that the senior scientists who take the senior authorship. The acknowledgement of farmers' view is very seldom made. When Ramnivas of village Janjariawas revealed to us extremely insightful methods of anticipating environmental contingencies and coping with that in semi-arid part of Haryana. He surely did not do it for getting acknowledgement (Gupta, 1980). However, the insights he provided have been an extremely useful building block of our efforts later on. It might be a good idea to acknowledge specific contributions of farmers by name wherever it is due.

i) It may be useful to monitor number of times the programme leader and other senior scientists visit not only the FSR sites but also the farmers' fields to generate feedback and supervise trials falling within their jurisdiction. The top management who compile this data and share it with everybody in the university or in the institute so that the scientists feel the pressure for spending more time in the field.

j) Whenever there is any environmental catastrophe, natural hazard the management of the research organization should monitor the efforts made by the scientists to provide contingency option to the farmers. Since the range of this option will have to be wide much will depend upon whether scientists have already catalogued such option discovered by the farmers. While designing trials the contingency options must be provided for so that no trial in the farmer's field is done under sub-optimal or otherwise in a prepared condition. Very often to maintain the consistency of experiments and need for data for consecutive three years a trial is continued year after year no matter whether in a particular year because of climatic factor the same made in the sense or not.

k) Monitoring of Post-Graduate Thesis Titles to Generate Future Supply of Appropriate Skills

Much has been written on the need of involving scientists in doing research with farmers but the most important aspect of building world-view among the budding scientists i.e. the post-graduate students has not received adequate attention. It would be useful to monitor the number of case studies based on farmers' experiences are used in the curriculum for various courses. Likewise it is very necessary that every year data about the number of students choosing different crops/enterprises and problems therein

shared widely among scientists, students planners and the dinors. We have recently reviewed 10 years data on post-graduate research in five disciplines in more than two dozen agricultural universities. We have discovered that there are extremely shocking gaps in terms of the research of problems of poor in risky ecological context (Gupta, 1987). It is inconceivable that any major breakthrough in future can be achieved unless scientists who have done their research on risky problems are enabled to man the positions which may become available with increased international tension towards these problems. Specific fellowships and inducements would need to be provided to attract the students towards such low priority problems.

Another structural feature which prevents the students from taking high risk problems for their Ph.D. research is the uncertainty of getting data which the academic establishments consider as vital for granting the degree. Unless the alternative way of rewarding effort is set up one should hope to get many students leured in this direction.

## Part Five

Marginal farmers and Marginal Researchs : How will developmental deviants survive?

A serious issue concerning the design of enabling organizations is to outline the processes through which following dilemma will be resolved:

- a) How to insulate those researchers who will question the hegemony of established research priorities and thus invite the wrath of the dominant scientists?
- b) How to identify budding scientists who have the potential for challenging the orthodoxy in a scientifically rigorous manner?
- c) How to network the 'odd balls' or the developmental deviants who unmask the ethical and value judgements involved in biological research?
- d) How to begin from the position of honourable compromise between the ongoing research processes towards an alternative agenda?
- e) What should be the role of various sources of power outside the research organizations which will thwart or encourage more focussed research aimed at problems of poor farmers in risky regions?

We have some evidence of junior scientist being transferred from one research programme to another just when the victory is on the anvil i.e. a variety is to be identified. This helps in preventing sharing of the credit with this unfortunate worker. Some might argue that this is true for any research programme. Thus why should it be mentioned in present context. Our response to such a question is that the implications of these questions are far more serious for innovative research system where stakes are high.

We mention below some ways in which the managers of OFCOR can try to deal with this phenomena.

It should at the outset, be made clear that we are not making a case for institutionalizing entire deviance in the organization. No organization can exist without some standardization of systems and expectation of compliance. However, where an innovative organization differs from a not so innovative one is in its ability to legitimise the plurality.

- It may help in diffusing false dichotomies (e.g. not all technologies can be class specific. Thus if some were to argue that there existed always a neat distinction between technologies for rich and technologies for poor, she/he would be creating a false dichotomy).
- It may tolerate the deviant researcher who may be thinking faster than his colleagues or whose calculation may make work on some 'esoteric' problem rational. But this 'rationality' may not be apparent to colleagues who have not gone through all the argument that this deviant researcher has worked out in his mind.
- It may enable the deviant researcher to be put in touch with other similar deviants. This would eliminate the feeling of being 'unique' in one's conception. This may moderate the expectation of the deviant researcher from the organization. He may consider tolerance as sufficient compensation for all the professional indifference such a researcher may have to face.
- It may encourage the researcher to seek an alternative peer group which would help the organizational leaders accord proper importance to the work of this researcher. Such feedback from outsiders is in fact used in some innovative organization to moderate the internal criticisms.

However, regardless of what an organization may do to tolerate, encourage or annihilate creative deviance in the organization, the fact of the matter is that deviance can acquire legitimacy but not institutionalization, for it would then become a contradiction in terms.

If a behaviour has been institutionalized, it is no more deviant. It is part of the legitimate range of activities. Having discussed the concept of deviance and its implications in general terms, let us look at the issue in context of research on poor or marginal farmers.

Studies have shown that historically, the research organizations in most developing countries began with cash crops during colonial times. The clients in such cases were well defined and the expectation generally quite unambiguous. Designing organizations with such clear goals and purposes posed a different challenge than what dryfarming research organizations face today. These organizations evolved a culture and a set of norms which proved useful when other similar organizations were set up later.

However, several innovations were made in India such as setting up of All India Coordinated Research projects (to avoid wastage and duplication and also to make knowledge as common property); starting Operations Research Projects, lab to land programmes besides of course setting up specialised institutes in addition to universities modelled on the pattern of land grant university of U.S.

Within these research organizations several unusual achievements were made in crops such as Cotton, Bajra, Jowar, improved varieties of Arhar (Pigeon pea), Oil Seed like Summer groundnut (one of the most creditable successes in recent times) in context

of rainfed but partly irrigated crops. We don't have to recount the success with regard to irrigated crops.

However, A legitimate question then would be: If all these gains could be achieved within existing organizational designs, why do we need new structures?

The answer, unfortunately is disturbing. We still have not achieved any substantial gains in regard to purely rainfed crops and other enterprises like sheep, goat and camels reared by poor pastoralists. In case of hand tools and many bullock drawn farm implements, our record is equally unimpressive. This problem is far more complex in African context where even manpower and material resources do not exist in sufficient quantity.

Our experience based on an exploratory study completed in 1985 and reported recently is mentioned here in quite tentative manner : We have not received so far the formal feedback from the colleague scientist or leaders of dry farming research programmes. Some of the finding were indeed presented at a Seminar at H.A.U. (Haryana Agricultural University, Hissar) in Summer of 1985, attended by scientists from five different natural and social science departments. However, despite this, we could appreciate if the readers do not quote these ideas without prior reference to the author:

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\* The study referred here was started in 1984, December and completed in mid 1985. The second draft has been sent to colleagues in 1987. ANIL K Gupta, N.T. Patel and Rekha N Shah, 1987, Matching Farmers concerns with technologists objectives : A study of scientific goal setting in Dry regions, Centre for Management in Agriculture, Indian Institute of Management, Ahmedaad, mimeo. We are grateful to Ministry of Agriculture, Government of India for providing support for the research.

i) The identification of client needs, we have argued was easier in irrigated agriculture perhaps because the background of most of the scientists (who came from rural settings) material with that of the irrigated farmers. In other words, apart from the similarity in the condition of station with irrigated farm, the agri-business, extension system, bureaucracy, and media also helped in linking the science centres (i.e. agricultural universities and institutes) with application peripheries (i.e. the farms of irrigated small and large farmers).

The same strength continues to exist even today. But it may as well be a limiting factor in case of dry farming research.

ii) Most dry farming scientists who come from the families with irrigated land holding did not consider risk or technological inadequacy to be the problem of farmers. They seemed to believe that if extension would work better and credit and other support services improve, the technology would diffuse. The problem did not exist inside the science centre. It existed out there.

iii) The problem of scientists with background of low risk environment working on problems of high risk may not pose much problem if (a) either they have been exposed to the problems of high risk agriculture at the student level or (b) they have been encouraged to have sufficient interaction with prospective client groups. As for as the first is concerned the evidence is very disappointing. Reading (b), the studies on ORP (Desai and Patel, 1985) also do not paint an optimistic picture.

Under these circumstances, the alternative seems to be to generate debate on the client needs and control in the biological science professional associations. In every

science congress or annual meeting of say, Agronomy society, Plant Pathology society or Genetics Society, there ought to be few sessions on exchange of information between

- a) scientist with rural background;
- b) Extension workers
- c) industry interests
- d) social scientists who have worked with poor farmer;
- e) Ph.D. scholars who are working on client oriented problems.

A step in this direction has already been taken informally in connection with the forthcoming International Congress of Plant Physiology proposed to be held at IARI, New Delhi in 1988. (Anthony Bottroll personal communication 1987).

Thus, the scientist may be encouraged to develop a feeling of discomfort with what they think they know about the client needs already (either by way of projecting their own experience on to others or by way of substituting analysis by assertion).

iv) The discussion with post graduate students to understand the factors which prevent them from taking research problems involving high risk provided several interesting insights. It appeared that timely completion of thesis was an important concern. It was generally feared that risk of crop failure could extend their thesis time (minimum of 2-2 years data was considered necessary for a Ph.D. We have also reviewed all the postgraduate thesis abstracts published in HAU Journal of abstract during 1973-1983 in five disciplines viz. Agronomy, Plant Breeding and Genetics, Economics, Sociology and Extension.

Research on enterprises pursued by some of the poorest people like sheep and goats, totally rainfed crops grown in drought prone regions like inferior millets etc., was

negligible. There were only three thesis completed on indigenous knowledge all guided initiated by the same professor (Dr. Y.P. Singh then at HAU, Hissar and now at AIRI). We recently learned, there have been 3 more post-graduate thesis, one at NDRI, one at Agricultural University at Coimbatore and another at HAU, Hissar 1986, (Singh 1987 personal communication).

Thus thesis seemed to some basic problem with the M.Sc. and Ph.D. granting system which has led to such a situation.

We have argued that to encourage postgraduate students to pursue research on problem affecting poor people in high risk environment, we must

- a) generate a system whereby we can reward input or effort rather than output; i.e. rewarding efforts put in developing new crosses of lines of crops or information on adaptability, heritability when the drought leads to loss of material.
- b) make it possible for students to acquire skill of data processing by gaining access to data generated in the normal course of departmental research programme but not prevent them from getting degrees if due to factors beyond their control, the experiments do not generate results which were expected;
- v) The data on journals referred by the students most often also indicated that while social science students did refer to some general crop science journals, the reverse was not the case at all. So much for the interdisciplinary research. We strongly believe that to generate organizational climate for poor client oriented research, the intervention at the level of curriculum, pedagogy and post graduate enculturation are extremely important. It is well known that several small changes simultaneously in many sub systems will be needed to produce few desirable changes in the system outputs.

vi) The data on arrangements for communication amongst the scientists indicated several problems in so far as they relate to the travel facilities for the scientists to different regional research centres of other universities. Some of the research programmes could not even have an annual or biennial national level meeting. Such constraints did not perhaps affect the programmes on irrigated crops like wheat, sugarcane, cotton etc.

vii) There were some other quite important differences of opinion amongst the scientists and the farmers on relative importance of grain & fodder in the millets. Within farmer, the poorer farmers preferred lower Harvest Index (i.e. grain to fodder ratio, other things being equal) compared to richer farmers. The objectives of scientists and richer rainfed farmers seemed to match.

Further, it was observed that while appraising results of various Dry farming experiments the researchers did not include data on fodder (even though it was collected no doubt).

This certainly was one of the most important disjunction between client needs and the goals/concerns of the researchers.

One need not attribute motives to the scientists for such a behaviour. Perhaps, given the public policy context the scientists also gave higher importance to grains and neglected the fodder related issues somewhat. We have learned that in Bajra breeding programmes at HAU, some corrective steps have already been taken to modify the plant type (Kapoor 1985 personal comm.).

Two issues became clear from above discussion:

a) There is a mainstream trend be it with regard to post graduate research or dominant research goals in most research programmes.

b) There did not seem to exist many ways of either identifying or sustaining deviant trends in research at any level\*

We have suggested (Gupat, et.al., 1987) the need for some organizational space for research to pursue individual curiosity even if the problem did not meet the overall research programme goal entirely.

We now revert to some of the questions posed in the beginning of the chapter.

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\* We had asked the scientists to list the problems (a) on which they wanted to work but could not; (b) they started and discontinued. We also wanted to know the reasons for discontinuance. We came across only one case where because of poor client's interests, a researcher had changed his research programmes. We came across several cases where scientists wanted to continue work on their Ph D problem but because of job exigencies could not do so.

There were

several other reasons cited as responsible for not initiating or discontinuing research.

#### Legitimacy of client oriented deviant research

When we discussed the issue of deviant research, we did not discuss the differences which may arise in management strategies for poor vis-avis rich client oriented deviant research. For instance, a request came from Jamalpur research station to OFRD head quarter at BARI Bangladesh that the Betelvine growers were facing serious problem. The issue had come up several times in the District Technical Committee comprising of scientists and the extension workers.

The programme leader faced a dilemma> Different stations had been asked to suspend further surveys till ways of coping with huge unprocessed data collected in past could be worked out. We also wanted the scientists to first list various issues which needed surveys so that prioritization could be done. In this case it was very obvious that Betelvine growers could by no stretch of imagination be considered poor. If resources were scarce, where would the marginal productivity in terms of social gains be highest. The researcher concerned was asked to list other equally or more relevant issues of urgent nature and then make a proper case. He was also advised to keep client interests in proper focus.

The concerned scientists felt dissatisfied and perhaps considered the behaviour of programme leader as bureaucratic. However, we must confess that in most research proposals which were discussed in the research review meetings earlier, no specific reference to client needs was made. This is not to suggest that research did not have direct implications for client needs. The rationality had to be implied, it was made explicit.

Unless, we provide a contest between alternative conception of rationality we would not be sure an opportunity for articulation of clients' interests has been provided.

Thus, the managers of OFCOR have not to spend time in monitoring specific research programmes. Their scarce time would have a higher pay off if they monitored

and influenced the processes in vogue to allow different interests to be articulated, documented, debated and resolved.

No body would argue that this process will ensure ascendence of those who espouse the interests of the poor. What we are submitting is that once the espoused interests became known, the would be deviants canwork out the transaction costs involved in sticking their neck out and persisting with their position. He can be forwarned. Whether he will be forearmed depends upon individual proclivities.

#### Transaction Cost for Research for Poor

We have argued in earlier sectons that in poor endowed regions the costs of transaction with farmers, extension works and even head quarters are higher. Managers by budgeting these costs can generate proper signals.

#### Time frame for appraising research proposals: Longterm/short terms

It has often learn noted that shortterm result oriented proposals receive more favourable response from peers as well as superiors. Howeer, some of the problems involving high risk call for longer term research interests. The research bureaucracies world over have yet to evolve the ways of appraising the negative externalities of short term research projects such as

i) preference for easily measurable variables rather than more important variables:

rather than more important variables:

ii) use of reductionist approach (parts could be added to make a whole) rather than

system oriented approach:

iii) choosing problems which are amenable to short term analysis etc.

One way in which problem of complex portfolios of crop, int, livestock, tree, craft and labour evolved by poor can be analysed is to have longer term cross cultural research programmes.

It is pity that longterm proposals qualify for being deviant today.

Perception of Client needs: Whose clients : which needs

We mentioned in the beginning of this paper about the paradox of unmet needs and articulated demands.

Natural Scientist, no matter what we the social scientist say, have realized the merit of tunnel vision. They have seen rewards flowing to those who have worked more and more on smaller and smaller parts of the problems. Some scientist at a later age may talk about the need for holistic vision and multidisciplinary research. When they were pursuing their career rewards, they had a different logic.

The issue thus is when scientists claim immunity from social accountability on account of the `rationality` of tunnel vision, they are actually making explicit two types of limitations.

- a) instrumental
- b) paradigmatic

Both need to be tackled properly before a major restructuring can be expected.

Some methods of overcoming instrumental limitations are illustrated in next section (last six). Many more were discussed in a recent conference on Farmer Participatory Research: complimentary methods at IDS, Sussex (uly 27-31, 1987) . However, the paradigmatic limitations were merely articulated and that too by a minority of participants.

This, therefore, is the problem. Honorable compromise between the managers of on going research process and those advocating alternative agenda take place only when both side understand each others' position well. We strongly beleive the social scientists have not made enough efforts to understand the biological science and the rules of pursuing the problems in their paradims.

Our execeptions about the opposite are illegitimate. We can not hope natural scientists to take initiative in understanding social implications of their research. After all, they have delivered the goods and as Ruton (1982) says, they are the golden goose.

We are not sure, whether we are talking about killing this goose (as Rutton implies) when we talk about horizontal accountability towards poor clients. The goose can lay eggs perhaps more often , perhaps different types of eggs.

#### Part-Six

#### METHODOLOGICAL APPORACH.

We have discussed several methods here :

- a) Ecological mapping .
- b) Manual Discriminant Analysis ( MDA )
- c) Four - stage interactive and interative case study method

(with or without sample survey)

- d) Decision tree analysis of farmers' trade-off under risk
- e) Multi enterprise eco-complex case study and mapping-homestead analysis involving woman scientists and

### Ecological Mapping

This method is described in annexure-I along with the key assumptions and step by step approach of following the method. In addition to the factors mentioned in section 2 it may be added among the farmers and the scientists. The maps are a means of communicating without any ambiguity. Such a degree of precision cannot be achieved in any other mode of communication. Further the maps also make it possible to identify the limits of physical variables in explaining evolution , diffusion and discontinuance of technology. If these maps are prepared repeatedly over the years and used as a method of updating the respective understanding of the socio-ecological environment then this could be very helpful tool of keeping a close touch between scientist and framers.

As already mentioned the whole issue of recommendation domain has been extremely blurred by imprecise testing of the assumptions underlying the domains. For instance large number of scientists in South-East Asia use soil series and phases as basis for theological extrapolation. It is not unusual to find scientists working on farmers' field to suggest that they were developing technology for X or Y soil series. The empirical has been put by the scientists in this method.

Many times those who argue loudest about the farming system research are extremely weak when it comes to expanding the theory by which interlinkages between different enterprises would be analysed or understood. It is not unusual, therefore, to find farming system research reports including sections on crop, livestock forestry, etc which are integrated by just stapling them together. The ecological mapping provides a basis for superimposing maps of one region over another and thus see evolution of species combinations as well as management practices. For instance, if the cattle density is also highest in the regions where Lathyrus (Khesari) cultivation is high, the relationship between cattle and Khesari is not difficult to understand and analyse. This also implies that selection criteria of varieties of Khesari for this exception area, recommendation domain or ecological niche would have to be different from another niche where even though Khesari is grown but not primarily as fodder. Therefore the method provides ways for linking data - knowledge - indifferent in a cogent and theoretically sound manner.

#### Manual Discriminant Analysis (MDA)

This method is described elaborated in Annexure II. The logic of compare and contrast underlying this approach is even though very obvious and yet not very often used in analysing farmers decision making. The assumptions that any decision maker is fully aware of the uniqueness of his or her standpoint is not considered quite common-place by the practitioner unless so identified by an outsider. This method provides due respect to the scientific skills necessary for logical drawing of inferences. At the same time it is also assumed that there is no theory by which one can anticipate the basis of diversity in a particular region without cataloguing or benchmarking the real data about same. Even

though it is not difficult to test the hypothesis if sample size is large and if some statistical test can be performed on the same data base.

The fact that most international centres for agricultural research have followed the TOT ( Transfer of Technology ) approach ( Chambers & Jiggins 1986 , Gupta 1980 \* ) is illustrated by the sequence of steps which IRRI follows. The purpose ostensibly is to reduce diversity rather than to comprehend and build upon it. At the same time the assumption that one could move from site to the extrapolation area rather than vice-versa also is

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\* We have discussed a matrix based on the interaction between communication and power elsewhere (Anil K Gupta, 1980, Communicating with farmers, Indian Institute of Public Administration, New Delhi, mimeo) . Four cells of this matrix are :

Communication

One way      two way

POWER      One way  
                 two way

The case 3 cannot exist. In most systems of communication one notices cases of type 1 and at best 2. The poor farmers have very seldom have power over scientists or extension workers. If there is some power it is only for the richer farmers who provide their plots for trial or who gather crowds when the senior officers visit the research sites. This is one of the major weaknesses of the on-farm methodology developed by the international centres of research found to be difficult in the present context. There is no escape from the fact that diversity of germ plasm, selection criteria and management practices are interlinked. There was no reason why farmers for centuries would have

selected so may different lines and varieties in the same region not to speak of the crop rotations. Studies have shown that even in a small region the number of crop rotations followed by a given number of farmers is atleast a multiple of 4-5 times of the actual number of the farmers. Much of the research on the cropping patterns become difficult to appreciate when one takes into account such a high diversity.

Another implication of MDA is for the technology transfer systems. Once the scientists and extension workers recognised that farmers appraise their choices of multiple scales and parameters they would have to shed the simplistic assumptions of systems like training and visit about the capacity of farmer to comprehend complexity. The transfer of science instead of technology would become then the key principle because many of the farming practices would be found backed up by a sound science. Whenever the cases of right decisions for wrong reasons are found the feedback of the scientific basis of the decisions to the farmers will improve or update or infuse the scientific temper amongst the peasant groups.

The care to be taken in this approach is that one should not delegate the method of data collection and feedback to the field assistants or research assistants only.

This method also helps in demonstrating empirically that biological scientists are as much capable if not more as social scientists in fathoming complexity of farmers' decision making.

### Four stage interactive and iterative Case Study Method

This method was developed during 1979-80 but was revised and tested at a larger scale in drought study in 1981 (Gupta, 1983)\*. Later this method was used in an action research study on rural banking (Gupta and Shroff, 1985)\*\* and for Farming System Research in Bangladesh (Gupta, 1986)\*\*\*. A brief method is given in the Annexure III. It was modified for the purpose of a homestead study by the women scientists of Bangladesh Agricultural Research Institute in collaboration with on-farm research Division, Horticultural Division and the Economics Division of the Institute. The method is participative, interactive and iterative. The contradictions in the role of farmer household as an active entity interacting with the environment and the passive onlooker constrained by the institutional, technical and organizational facets of the environment are documented (Gupta, 1983 : 16). The method implies learning about the decision making environment through the eyes of decision makers at different levels. In different contexts different approaches can be used; for instance for study on the poverty process in drought-prone regions we had taken help of high school students, graduates and post-graduates in addition to social scientists, voluntary agencies, field officers and managers of banks besides full time researchers.

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\* Gupta, Anil K., 1983: Impoverishment in Drought-Prone Regions : View from within SDC NABARD IIM Ahmedabad.

Gupta Anil K and Manu Shroff, 1985, Learning to Unlearn an action research enquiry into rural banking, CMA-PSG, IIM Ahmedabad;

Gupta Anil K 1986, Survival under Stress, A note on the case study method, BARI, Joydebpur.

The key steps are:

### Step 1

To clarify basic assumptions behind the method (I) there are questions which are relevant in the context of a specific household but can never be anticipated by any outside researcher (ii) by the same token there are questions which researcher, would think very relevant but prove to be totally irrelevant in the real life context.

### Step 2

The assumptions mentioned above have to be demonstrated empirically to the researchers involved in the case study development exercise by keeping a list of questions ready and later on demonstrating to the colleagues that it did not have some relevant questions and that it also had many irrelevant questions. This helps achieving two outcomes. One it demystifies the knowledge of the expert scientists or researcher or even social scientist and second, it generates a greater confidence among the colleagues about their ability to excel and innovate beyond the capacity of the researcher in specific case. A competitive spirit between the experts and the colleague researchers is very necessary if a dependency has not to be forged and if access to the insights that will occur only through interaction has not to be denied to individuals as well as collectivity.

### Step 3

The four stages which are used in this method and are briefly illustrated in Annexure are gone through i.e. the researcher selects the family and discusses the purpose of research documents and the experience. In a meeting of the researchers they share what they have written. A distinction is made between what has been written without observing and what has in research finally determines who does what and for how long. The experience of B'desh is a sad testimony to this reality in more than one

way. been observed but nor written. Mutual questioning provides an additional list of questions for each researcher to be pursued in the second round.

The information is sought either by staying with the farmer(as was done in the drought study) or by visiting him (the respondent) at his convenience. Again the same process of interaction is repeated where the experts as well as the colleague scientists ask each other about the logic of the inference which many researchers start drawing from the observation that they have made.

In the third round the researchers go back to the same family and try to pursue the context of the decision making by way of studying his or her links with the markets, institutions and neighbours. The idea is to incorporate the so called exogenous variables within the realm of the study. Another round of discussion takes place, and in the final and fourth round apart from tightening the loose ends the farmer reads out the whole case to the family. This is one of the most important ethical and scientific obligations of the researcher working with the peasants. The ethical obligation is that we have no right to use this information provided by the farmers without their explicit permission (see Gupta, 1987). The Scientific basis is that only when we feedback the whole narrative to the family they fully understand as to why did we ask the questions that we did in the first place. At this stage they say, “Oh!. Now we see what you wanted to understand.. Had we known it earlier, we would have told you X , Y and Z. Since you did not ask those aspects we did not provide you that information”. “It is our contention that this information cannot be obtained by any other method available or developed so far. This new data comes out only when the context of enquiry becomes totally aparant to the farmer family.

Step 4: Subsequently a one or two page questionnaire can be prepared on key farm practices or technologies or aspects of which one may like to find the universe through cross sectional sample survey.

Step 5: A seminar or workshop can be organized in which the findings of each case study are put together and feedback of the farmers is sought collectively. When the groups of farmers observe the uniqueness or otherwise of their experiences, an intense group dynamics ensues.

One of the important implications of this method which the scientists in B'desh reported was that it generated extremely important and productive group dynamics among the teams of the scientists itself. It was often found that the status was not correlated positively with skills. This is the case studies prepared by the junior scientists or staff were found to be far more comprehensive, informative and enlightening than the ones prepared by the senior scientists in many cases. There were no other way in which many of the scientists would have confessed their inadequacy before the juniors. And there is also no other way by which a team spirit can be achieved without acknowledgement of mutual inadequacies.

The limitations of this method are the following:

- a) It requires tremendous intensity of involvement on everybody's part.
- b) It requires the senior scientists also to demystify their knowledge and their skill of learning from farmers.

c) There is a need for a facilitator to demystify his own knowledge and thereby demonstrate the uniqueness of the insights which he has learned and which he did not know before.

d) It requires patience on the part of research managers who would like case studies to generate research programme immediately without recognizing the institutional process which such a method helps in bringing about.

#### Decision Tree Analysis:

As shown in the figure 3 a decision tree is a very helpful tool of compressing enormous amounts of information about the phenomena. It also helps in analysing the trade-off progressively over time and space. Further this method enables the researcher to recognize the way individual rationality works. For instance when the data on cropping patterns was organized as per the decision tree the scientists were asked to rank each pattern and also assign weights indicating the importance each pattern may have on the land holding of different classes of farmers, Later the data from an empirical survey was collected and provided to the same group scientists to compare the validity of their hypothesis.

A very important outcome of this approach is that it helps in disentangling to some extent the role of class and ecology in the decision making of the farmers. Certain choices of crop sequence are found to be far more important on the holdings of better endowed farmers just the way certain other patterns are found important elsewhere. The decision tree analysis has been used by different disciplines for a long time. The modification that we have made is to link the environment induced

tradeoffs with economic constraints or opportunities. Further, our approach calls for comparing the hypothesized decision terr with the actual one with regard to both edaphic, climatic and economic parameter.

### Understand Multi-Enterprise eco-complex

Study of homesteads through involvement of woman scientists. This method was developed more to get out a challenging dilemmathat to consciously come out with the sequence of steps described here.

The issue was that horticultural department of BARI, B'desh wanted to do a survey of Homesteads in different parts of B'desh. They were told that farmer's feedback is necessary before drawing up a research agenda. They had drawn up a questionnaire which ahd all type of questions.<sup>1</sup> Counsultatns from an international centres of research in vegetables had visited the country and rainforced the notion that those knowing nothing about the intimate details of a

In one of the questinnaires proposed for homstead survey at a FSR site, a consultant added a qeuestion, How much area under vegetable is in light and darkness? He forget to add at what time of the day. A map of all fixtures on the homestead was prepared (see figure 4 for illustration) identifying each plant (tree, vegetables, bushes etc.) space for tying animals dwelling, waste disposal etc.

### Step 3

A discussion was held regarding all the three coordinates i.e. space, season and sector which plant was grown where and why. Why were certain frequency distribution observed. Why were some species found to be in greater number than others.

#### Step 4

The multiple uses of different plants were noted in order of importance along with the limitations or disadvantages if any. If certain vegetables were more vulnerable to damage by poultry than others, it was also noted.

#### Step 5

A meeting was held in the OFRD in which those who spoke about the haphazard\*, and random nature of the homestead map bio mass were asked to explain and interperct the homestead map. After long discussion, it was recognized that the scientists with all the knowledge of the basic and applied sciences could not explain the rationale or otherwise of the choices at a particular homestead.

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The logic of haphazard on random distribution is very seldom recognised by the scientists. The line sowing is considered scientific and everything else unscientific. The research on broadcast line sown rainfed wheat showed no advantage of line sowing even on the research station. Likewise, the same may hold true for the trees. Although, not all decisions are random in any case.

Space-specific interactions at the homestead level : Key to species and count

1.0 The key for the homestead diagram

<u>Name of Tree</u>	<u>Number</u>	<u>Symbol/Abbreviation</u>
1. Mango	13	H
2. Jack Fruit	5	J
3. Black nerry	6	Bi
4. Lichi	4	L
5. Datepalm	9	D
6. Palm	13	P
7. Guava	9	G
8. Lemon	3	Le
9. Wood apple	11	W
10. Bullocks heart	3	Bu
11. Tamarind	4	T
12. Pomegranate	1	Po
13. Beer	4	Br
14. Olive	1	O
15. Banana	22	Ba
16. Papaya	2	Pa
17. Codbel	1	C
18. Coconut	2	Co
19. Jambura	1	Ja
20. Amra	1	A
21. Pineapple	xxx	Pn
22. Arum	1 cluster	Ar
23. Pigeonpea	11	Pp
24. Aroid	1	Ar
25. Country Bean	xxx	B
Forest Plants		
26. Korol	2	K
27. Teel Karol	3	Tk
28. Mandar	12	Ma
29. Datal	9	Da
30. Wood Ollvw	2	Wo
31. Bajna	1	Bn
32. Neem	9	N
33. Bamboo Bush	1	BB
Shrubs		
34. Bukhak	xxx	Bs
35. Tulsi	2	Tu
36. Pahari	xxx	Pk
37. Lactus	4	La

Step 6

At this stage, the idea of pursuing detailed case studies (in this case, the four stage were compressed into 2 rounds) with the help of women scientists from other divisions of the institute was pursued. Never before had these women scientists ever sat together. Moreover since most of the decisions at the homestead were assumed to be made by women, it was considered necessary to take help of women scientists.

Step 7

The women scientist went out to different parts of the country to develop case studies. The narratives were discussed with the male field scientists to get their feedback. A large number of innovative practices emerged. It was suggested that gender specific issues in on-farm research need be raised from a different point of view. The focus should be to highlight the role of women as scientists rather than just as exploited workers or contribute to post-harvest chores.

Step 8

The myths in which head quarter scientists believed in and which were blown were systematically documented in form of hypothesis for further work. There was considerable concentration among scientists to note that synthesis of women case studies was done by male scientists (who did not involve women scientists for whether reasons in this process).

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\* It turned out later that not all planting decision at homestead were made by women. The decisions to leave tree seedling which have emerged spontaneously (i.e. have been purposively seeded) intact or uproot was generally made by men while vegetables and medicinal plants were tended by women.

One of the typical examples of such myths was given by a senior horticulture scientist in a meeting at head quarters who said that women did not use the space and water properly. Thus many vegetables could not be grown. Later when this particular issue was pursued, it was learned that water was a scarce resource during winter. The alternative uses were for washing cattle (which may get diseases otherwise), personal hygiene, cooking and human consumption and irrigation of vegetables/trees after all not a very bad decision or proof of irrationality.

#### Step 9

A workshop of all the participants in the research programme besides researchers from other institutions was organized. The women scientists complained of not having been fully involved in processing of results or organization of workshop. But at the same time, they agreed that they could complain because (a) there was a workshop and (b) they felt involved.

The most disappointing feature of the follow up was that some of the concerned horticulture scientists felt prey to the donor pressure to start work notwithstanding the need for research and survey to find the universe of the hypothesis. The women scientists were not consulted in the decision of follow up research programme. This has been mentioned to highlight that in many developing countries, one should not assume that lack of innovative research was caused by lack of focus or proper methods. The contradictory pull of multiple donors, all of whom seem to have suddenly realized the

need for farmer's involvement in research finally determines who does not what for how long.

### Scientists and Extension workers' workshops/interactions for innovation scouting

Several researchers have made a plea for scouting innovations, testing them and only then suggesting their replacement or upgradation (Hra Nand and K Kumar, 1980). Nand and Kumar have argued for redefining the role and relationship between extension and research. They gave three examples of technology developed by the farmers which scientists also admitted as unparalleled.

1. Randa (Blade hoe) an implement to open up the upper 2" layer of soil and at the same time compress the lower 2" layer compressed for minimizing the moisture loss.

2. Cloth or gunny bag wrapped around plough shear

This helps shallow sowing and lesser covering of soil on the seed. This was found by the farmers a better and cheaper method for achieving what ridger seeder could do at a cost of Rs. 4000/-.

3. Plank fitted with Nails

This is an ordinary planker made of wood fitted with nails to break the crust and conserve the moisture.

In a workshop of Scientists and Extension workers organised by Nurul alam and his colleagues from the ON Farm Research division of BARI and Rafique Ahmed of DAE (directorate of Extension Bangladesh) the lowest level of extension staff were asked to list those practices which they considered intriguing. They were not to judge their efficacy or otherwise while listening to these. As shown in table 4 a whole range of practices emerged which needed to be tested before these could be considered worth anything.

There are two points about these workshops.

1. Even the boss i.e. District Agricultural Officer and N Alam, incharge of OFRD site at Tangail participated in this process of documentation of practices. The game was that if some body could not cite any practice then he had wasted his life. We considered it impossible for any one to work with farmers and not notice innovations.

This provoked the participants and every body acknowledged that status and skills of perceiving farmers' innovations were not directly related.

2. We did not want the reporter to certify the accuracy or generalizability of the practice - after which would have led many to keep quiet.

We also circulated the list of the innovations with the names of the reporters next day. There was strong skepticism when we mentioned that we will acknowledge everybody's contribution. There was a sort of strange smile on everybody's face. They thought probably that here was another snake charmer who was taking them on a garden path. This also reflected the credibility we the social scientists have with grass root workers.

In table 5 contained we have given how Alam and his colleagues have converted some of the farmers practices into hypothesis. The purpose was to find the universe of these hypothese derived from case studies and innovation scouting from externsion workers as well as farmers and scientists working at station. Undoubtedly, many of these practices were extremely popular indicating high confidence interval on the part of the farmers even if the scientists were skepticl still. This scientists also had night village meeting with the farmers to discuss many of the innovations with elderly people separately than the young. The workshops to scout innovations could be extremely cost

effective way of eliciting the innovations which then can be followed up for indepthy study.

Farmer's belief and Innovative Practices : Untested by the Scientists

#### Part One

1. Subash : Opium insertion in bottlegourd stem increases the number of fruits.
2. Feroz : Non-bearing Papaya bears fruits when injected with Cholera vaccines
3. A. Rashid : If you cut male plant of Papaya the newer shoots bear fruits.
4. N. Hoque : Jute (cap) seed powders used for controlling stemborer insect in paddy.
5. A. Sayed : Juice of Talakachi Leaf mix with water sprinkled on leafy vegetables helps in control of heatles.
6. Awlad : Before 1 1/2 month of harvesting of T.man draw a strip at distances of 2-3' to control insects.
7. B.Roque : Broadcast ash over paccy to control insect.
8. Awlad : Plan and lacooring in wheat after 15-20 effectively control weed.
9. A. Sayed : Weed used for Rematode control in paddy (G.T.Z and CAR)
10. N. Alam : If the jute grown after wheat a nooular substance in jute OFRC roots leads - to mortality of jute seedlings (On farm research civision BARI. Tangail)
11. Murshic : Urea is used for controlling stemborer in Boro Paddy
12. Feroz : If non-bearing bottle gourd vines are given a longitudinal incision it starts bearing fruits.
13. Awlad : Powder of Neem fruit used in paddy to control insect
14. Bafique : Insertion of Tobacco in a vertical incision in vince of cocurbits increases bearing
15. Awlad : Sowing of jute (cap) after full meon/chaitre cirsoerc optimal.
16. Feroz : To soften hard banana of Shabrihola type, spath is cut and coudung is

tied.

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All these innovations have been identified by the staff of DAE (Department of Agriculture Extension, Tangail unless specified otherwise).

17. Awlad : If `Shazna' cutting planted after first shower in chaitin bearing starts within one year.
18. N. Hoque : When Sazha cutting planted upsioc down bearing is obtained round the year.
19. N. Alam (OFRD) : Banana plant is used for rat control in wheat (the resulting of leaves creates sound which keeps rats away)
20. Feroz : A longitudinal section after Amavasya (dark phase of moon) of Bhadra of Asian in Jack fruit help in bearing of fruits.
21. Khasru : Laddering practised in Eoro field after 1 1/2 month's transplanting to control weeds and pest
22. Nurshid : Laddering in wheat increases tillering at 20-25 days after sowing.

## Reality Mapping

This is a method which we have used in several contexts most recently in a women's workshop (July 12-13, 1987) to capture the way the poor people perceive their environment and relate to it.

What we do is to give colour pens and paper to assembled poor male or female workers, even if they have never handled a pen before in their life. There are many such people.

We then ask them to draw their village or any aspect of it which they see as important to their survival. Not infrequently, atleast many women end up making only simple but colourful motifs or designs rather than a Temple.

It is interesting to study which species they draw or what plants or birds they feel more comfortable in drawing. When we did this with women and men of different social background several interesting things appeared. (Incidentally we have tried this method with IAS Officers in India and scientists in Bangladesh individually and in groups).

We notice that not only the forms are very small but also often around a figure of temple in case of women. Hardly any means of transport figures in their drawing which is not the case with men. We are still doing more analysis of this approach of understanding the cognitive map and thus will not claim any significant gain. We could however, certainly recommend it as an unfreezing device tremendous creativity in group sessions as it happened when it was done in BARI, Bangladesh more bold and satirical in group paintings than in the individual ones pursued so far.

In the case of a dry village of Maharashtra where it was tried with the help of Mandavkar, a student at that time with IIM, it was noticed that while many poor people

drew only their immediate neighbours or fields the rich people drew far more details of whole village.

If this technique can be refined to understand the way people relate to their resource environment it could be a highly effective tool in deciphering the realm of consciousness of poor people drew far more details of the whole village.

If this technique can be refined to understand the way people relate to their resource environment it could be a highly effective tool in deciphering the realm of consciousness of poor people as different from the rich.

The utility of this method for building rapport or unfreezing remains even if other hopes from this method remain unfulfilled so far.

### **Conclusion**

The need for supply side interventions remains is not disputed here. We assert that the dangers inherent in underlining the issue of farmers' deemed too much is that we may end up creating caste system in research establishments? The fact that by responding to existing demand no organization can serve the disadvantaged has to be recognised. New demand have to be created. This needs which are not felt have to be made felt.

Those who work on the problems of rich farmers or cash crops or donor supported paradigms should not end up becoming high caste researchers.

The methods of involving farmers in the design of research process can only be appreciated in a theoretical framework in which

- a) class and ecological variables are properly related;
- b) organizational context of the research management is properly conceptualized;

- c) It is recognised that serving the interest of resource poor farmers is not a non-political proposition. If you serve them then you leave the interest of others either to be served by the market forces or by the remaining scientists (unless ofcourse the trade off is less severe);
- d) The implications of deviance inherent in the research against the mainstream are drawn. The process of networking organizational insurgents or developmental deviants are specified;
- e) The horizontal and vertical accountability amongst the scientists is ensured;
- f) The importance of supply side interventions is recognised so that on station basic reserach continues without generating false hopes from the on farm research, though the need for keeping organic touch between the two wil remain;
- g) The need for biological scientists to learn from poor farming households is recognised. It should be clearly understood that biological scientists can learn the social science concepts far more easily than vice versa.
- h) The monitoring system conducive for research on problems with uncertain outcomes will need to be developed;
- i) The link between post graduate students, curricula and research and the work on the farmers' fields will need to established. It must be understood that if three year data is must for a student to get a Ph.D. then not many will like to risk their career for the sake of poor risk affected.
- j) The implications of 4-S and 3-S framework under the socio-ecological paradigm need be drawn so that farmers' risk adjustment strategies can be matched with that of the organizations and research managers in them.

We have listed above issues in a random order. We recognise that not all of the issues in particularly part three and conclusions have been adequately discussed. However, we hope that this draft paper makes an effort to link OFCOR at demand as well as supply side. More explicit linkage is however, called for. The ahistorical structural-functional framework implicit in much of the writings on the subject is considered highly inadequate. Search for new paradigms is expected to be as contentious as any other struggle in academics.

The involvement of poor farmers and professionals on the margin in the research process is closely linked. Pursuit of one without other will mean positive discrimination against the other objective. We can still do it but we must make underlying values apparent.

## Foot notes

1. As the term implies, the domain of recommendation developed at a site will be governed by the ecological conditions of the site. The process is from site to the extrapolation area. However, the issue of selecting the site itself is left insufficiently elaborated. We have suggested that the site for different trials be the best niches identified through the ecological mapping. The 'new' best is then contrasted with the 'old best'. Diffusion of so proved technology will not require much efforts afterwards. The concept of the multilocation testing to be done sequentially after a technology has been proved at the site will need to be modified. The MLT will now become multi location trial. The idea is that for those technologies for which ideal conditions do not exist at the FSR site the trials need to be segregated at MLTs.

2. The problem arises when 'recommendation domain' so to say of different technologies overlaps partially or completely. One way is to leave the individual choices to market forces. Another is to take existing interactions into account and generate tiers of technology. Thus one would not face a problem which wheat scientists faced in Bangladesh. Right from mid sixties the CIMMYT consultants had been saying what local counterparts believed as a Mantra that one acre of boro paddy (i.e. winter irrigated paddy) could irrigate three acres of wheat. Thus they averred that with increase in irrigation farmers would replace paddy by wheat., The recommendation domain of Boro paddy and wheat were assumed to be same.

The wheat spreaded in the rainfed conditions where farmers found it an attractive alternative to pulses and oilseeds grown hitherto on residual moisture in the same regions. Wherever irrigation spread was higher and soils were not very light jacking irrigation costs of boro paddy it was paddy which replaced wheat and not vice versa. Thus on one hand it is not enough to talk of recommendation domain but also one should take into account the economic and social factors. On the other hand the recommendation domains could overlap in edaphic and climatic terms as was the case here but may offer very different pay off matrix to different classes of the growers.

3. The interlocking of factor and product markets implies that constraints and opportunities in one market are not independent of the choices in another market. For instance if a farmer took loans from a money lender who also determined the use of this money i.e. which crop to grow and how then in such a case we will call the credit and product markets as interlocked or interpenetrated (Bharadwaj, 1974; Gupta, 1981). The actual incidence of this process may vary in different regions but its role in articulation of farmers' needs vis-a-vis demands cannot be ignored. The case of lessor constraining the choice of lessee is far more widespread. In north west Bangladesh the landlords would insist that some local varieties of aman paddy will have to be grown by the farmers in some cases for their share and consumption. The farmers could grow any other crop in either remaining lands or season. The demand for innovation or compulsion for generating a particular resource use practice is thus deeply related to the institutional history.

4. Another feature of this method is to derive contingency options a weakness of both IRRI and CIMMYT models. As shown in Table 2&3 in the text based on the work of BAU Bangladesh (A Hussain, 1986) the crop rotations or patterns which were dominant in one year could disappear in another. The IRRI's methodology popularised by the fsr network would imply that after identifying the dominant CPs the scientists should work for atleast three years on developing alternative or improved cropping patterns. No provision for contingency options has to be made. Decision tree analysis makes the existing contingency options of the farmers apparent. One can do a small survey to find out which options are invoked by which class of farmers how often. Alternatively one can try to derive the rules by which different options are worked out.

Given these options one does not have to transfer the technology to farmers but the science underlying these options.

One example of science transfer was given by Hira Nand and Kamlesh Kumar (1980). They suggested that instead of making very general recommendations for fertilizer applications in rain fed crops one should try to develop a ready reckoner. It should make it possible for a farmer to find out under what type of soil for which crop and how much rainfall (and at what stage) which fertilizer should be given in what proportion. Let him do research and trial of his own to find out his plot specific fertilizer doses. In any case not many farmers really relied on the fertilizer recommendations many of which are just absurd. For instance it was found that scientists were using in BARI and other place same dose 60-40-40 of NPK in all the three crops of a rotation despite knowing the residual effects. The BARC guidelines were also loke wise equally defective. The BARI scientist corrected for this mistake immediately but the guidelines perhaps still remain. Likewise while farmers seldom use chemical fertilizers without mixing with some organic fertilizer there were hardly any trial. The combinations of organic and inorganic fertilizers cannot be worked out without using decision tree analysis because the rules will vary for different topography and crop combinations and rotations.

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## Ecological Mapping : Analysing Interplay between class and ecological variables in technological generation and diffusion

The geographers and human ecologists have tried to use mapping as a technique for analysing the physical chars of a region or context. The emphasis in such cases has been on categoraphic method of map making. The beginning point for us is to assume that same phenomena, say a watershed or a village or a district is seen differently by different people (researchers and extension workers) differently. Given these differences in the perception of the same physical reality it is natural that we have different theories-in-use to explain (a) the differences in the reality as it exists out there and (b) why we see different parts of the same reality more strikingly than others.

Benchmarking the perceptions of researchers and extension workers can provide unique insights about the operating assumptions that affect the definition of the farmers problems. When impresssionstic (and not ) maps are prepared about the niches of different technologies, crops, enterprises or management practices, there is a concrete basis for negotiating respective definition of the boundaries of the niches, relevant portions of the physical reality and other insights.

Exchanging notes about the respective ignorance and knowledge acts a great leveller of hierarchies. Humility, so essential to work in teams, grows through the process of making maps and acknowledging respective inadequacies. The assumed correlation between status and skills is empirically falsified. Once dialogue across the hierarchies takes place the dialogue amongst farmers and researchers becomes possible.

Assumptions:

1. The workers who have been travelling and interacting with in a region do develop extensive insights about the ecological endowments and peculiarities thereof.

2. The much maligned village development workers of extension department often have very precise understanding about the
3. The outer limits or boundary or niche of a technology be it traditional or so called modern - is defined by the physical ecological factors rather than the socio-economic factors. Institutional factors do however, make a substantial difference but given a structure the above statement holds true.
4. Notwithstanding thousands of post-graduate theses on the subject of diffusion of innovation the excessive emphasis on socio-psychological factors seems misplaced (see annex).
5. Farmers have a great sense of space and season and their interaction with seasonal choices. It is possible over time that many of the rules may have been codified into rituals. The avowed reasons and actual reasons may have to be distinguished precisely.

#### **Implications of Ecological mapping**

- a) Identification of historically evolved niches for different enterprises enables location of advanced technology trials. Often the trials of numerous technologies are pursued at the plots of the farmers who cooperate and whose plots are in the close vicinity of the farmer site. It does not have to be said that any new technology should be tried in the niche which is otherwise most suited for that enterprise. The check should be the local best technological practice or variety. The E M helps in identifying such niches.
- b) E M helps in hypothesizing the reasons for limited diffusion of technology. It also helps in designing appropriate marketing strategies for technologies.

c) It helps in understanding the rationale for specific crop rotations and mixtures, tree-crop-livestock combinations and most importantly the risk adjustment strategies of various classes.

d) Generally the poorer households are not randomly situated. More vulnerable the location higher is the probability that proportion of the poorer households is greater among the population. In case of Bangladesh it has been shown that the highest extent of the poor lived on the river banks and chars (riverine lands). The ecological conditions defined the range of economic enterprises that can be sustained in such a context. The scale of course depended upon the respective access of various classes to factor (land, labour, capital, information) and product (technology) markets, extended family systems, kinship networks, household communal, public risk adjustment options etc; (see Socio-ecological paradigm, Gupta, 1984). The ecological maps provide basis for exploring questions relating to the survival strategies of different classes of households located at different spaces affected by seasonality in characteristic manner and having specific sectoral choices.

### Methodology

How do we prepare the ecological maps?

We describe the methodology actually used first followed by the modifications that we now consider possible.

### Steps

1. The blank maps are collected for district/upsilla/gram sabha or village panchayat or ADO circle/. Depending upon the number of researchers and the extension workers available for reference and participation in the EM workshop, sufficient copies are made

of these maps so that each participant gets about 25-30 copies. These maps have only the geographic boundaries with no other detail given.

2. Each researcher and extensive of their maps to individually fill these up by showing the extent of different varieties and enterprises. Different symbols are used to depict the maximum, moderate and minimum extent of each of the enterprise. The maps are drawn by juniors as well as seniors for enterprise. The maps are drawn by juniors as well as seniors for entire area of their operation. At times the site incharge tend to take help of some beldar (labour supervisor) or other knowledgeable person. The purpose of individual mapping is to become aware of respective strengths and weaknesses as far as the knowledge of the site researchers about their command area is concerned.

3. Each map thus shows the area where say, maximum area under lathyrus (khesari) is cultivated or cows are maintained. Wherever it is possible the varietal differences are also shown e.g. if area under BR-10 and BR-11 varieties of paddy or some other local varieties is localised the same becomes apparent. It is made clear that in all the areas many of the same ent. are maintained but not in equal proportion. Thus one should understand the cost of parsimony.

3. Once these maps are prepared there are two options (i) to have a workshop to consolidate the individual maps into common sets after negotiation about the variety of respective claims (ii) to consolidate these maps in small groups in respective offices. The purpose is to recognize that many of the boundaries were not shar enough or precise enough. Some may have changed in recent past a fact which only the person at the local level could know. Some of the boundaries are really very fluid because depending upon

the year to year variations in the weather the acreage shift may be substantial. However, the range of this shift can in such cases be outlined; e.g. In years with floods in Aman paddy season in Bangladesh the acreage under the succeeding wheat crop generally increases because of good residual moisture and early availability of the fields due to premature harvest of aman in many places. These expansions will however still take place within the limits imposed by the edaphic and climatic factors.

4. The consensus maps so evolved have been found by professional geographers to be reasonably precise and accurate. It has also been found that the professionals down the line were far more precise than those at higher levels. Such maps are prepared for livestock, tree and vegetables also besides crops season and if possible variety wise. Separately the risk maps in terms of drought or flood intensity are also prepared. It must be mentioned that idea is not so much the agro-ecological stratification as the understanding of the ecology of different enterprises.

5. Once these maps are prepared the same are discussed with the panel of farmers to understand the niches of different varieties, crops, tree species etc. It is extremely revealing that the insights offered by the farmers are sometimes so precise that one wonders at their sense of space and seasons. The farmers are all too ready to tell as to why certain enterprise combinations are localised only in certain niches and under what conditions these niches may change. Such insights also give rise to another question and that is about the assumption that farmers need to be told only the capsulized technology and not the science underlying such advice. Nothing could be farther from the truth.

6. The reality eventhough may be same and yet affect different

For instance the sweet potato is cultivated by only the poorest prople on the high lands in Bangladesh but on char lands this crop would be found suitable by every body regardless of the class. Likewise the mixed cropping is generally preferred by the poorer households but on uplands and in sugarcane growing regions in Bangladesh it is found suitable by most of the people.

7. Another instance of class specificity may arise by way of the variation in the use of an enterprise may even be not only class but also caste and gender specific. The derooting of sweet potato wines is done by only the women who consider it helpful in the production of round tubers which fetch better prices than the long normal ones. Likewise the sisal is cultivated on the bunds of the fields and on low productivity soils in semi-arid western Maharashtra.

The skill of processing it into fibre is generally available with only the Mang. lower caste and generally landless community.

8. The EM thus helps in delineating the ecological and management context of different technologies.

It also helps in having a common understanding about the command area. As was recognised in Bangladesh, in absence of EM some of the older sites had neglected the problems of poor inhabiting some of the most vulnerable regions in Ishurdi.

9. When these maps are super imposed one over another the underlying rules of socio-ecological paradigm become apparent. The historically evolved interactions among various enterprises become obvious.

10. The prioritization of research programme can be attempted in terms of enterprises or sectors (i.e. ones important for poor or the rich), seasons (when the risk is higher and the results are less certain) and spaces or niches (where the risk vulnerability is high or where private market forces are weak and thus need for public interventions high).

## Manual Discriminant Analysis (MDA)

### A Tool for Fathoming Complexity of On-Farm Decision Making

In arid as well as humid tropics given the high variability in the ecological conditions the resource use practices are found to vary a great deal in different part of the same village. Such a variability may be a genuine response to the varying level of soil moisture, fertility and other residual effects of previous crops in different plots. Developing technologies which can cope with such endemic variability has proved to be extremely difficult. The result has been that either the on-farm research has been restricted to the upland where conditions are generally uniform or whether trials have been taken up in low lands the definition of treatments and control has posed enormous difficulty.

We may hypothesise that lack of on-farm research in such risky ecological context with empirically derived treatments may be because of lack of comprehension of the rules underlying apparent variability.

There are two ways in which one can tackle this problem. One to recognize the limitation of existing practices based on averaging the diversified resource use practices without taking into account the logical validity of such average. Second, to interpret the differences in resource use in mainly economic terms rather than identifying the role of ecological factors besides crop rotation and other plot-specific features.

The Manual Discriminant Analysis (MDA) enables us in dealing with these issues to generate viable alternatives for on-farm research aimed at resource poor farmers.

### Some Limitations of Existing Methods

One of the general questions in designing on-farm research trials and selection of treatments is to find out the logic of existing farm practices. The usual method is to do a survey of farm practices on enterprise basis say crop and then average out different parameters. Thus if one wants to do a trial on developing proper crop geometry in dry farming regions, one would find out the data on spacing (row to row and plant to plant) and average it. This would form the control treatment and later one or two treatments with values above this or lower than this are taken to develop a trend line or regression equation. The recommendations are worked out on the basis of such trials.

Other limitations of such an approach are:

- a) The Data Collection on crop basis instead of plot basis is highly erroneous and unscientific in such ecological contexts. If we assume that plot to plot fertility level, moisture level (depending upon drainage characteristics), crop rotation (depending upon previous crop) would vary, it is imperative that we collect data on plot to plot basis and later aggregate it on the basis of uniformity of basic condition. Otherwise what happens is that a farmer may have grown the same crop on different plots with varying micro ecological conditions and thus aggregation may create bias which makes analysis of the problem difficult.
- b) The average of farming practices be it seed rate, sowing time, spacing or some other parameter, masks the variability existing in the data. Some farmers use very high seed rate while others use very low seed rate. Average in such situation tells us very little because both the practices may be totally rational depending upon the specific physical condition. It is not to say that socio-economics condition could not effect such variability

(e.g. availability of limited draft power resulting in timely sowing of one plot while the other one is delayed) but we would not be able to explore such a possibility unless we would pursue it. The approach of averaging the data prevents such questions.

iii) Unlike the industrial context where an entrepreneur has considerably high pay off to individual innovation, in agricultural sector it is not very often that farmer can extract huge profits through individual innovation (vessuri, 1979). It does not imply that innovations do not take place amongst small farmer but the implication is that a farmer may not recognise the innovativeness of the individual adaptations. While some of the useful adaptations of such adaptations remain localised. The cropwise averaging of farm practices prevents us from analysing the possible contribution of individual adaptation or resource use practice towards yield increasing or risk reducing efforts of the farmer.

#### Alternative Method

In above context, the crucial issue therefore is : How to cope with the complexity of decision making at farm level so that

- a) the scientists can unravel the innovation which may not be apparent to the farmers;
- b) Comprehend the logic of farming practices in a manner that contribution of ecological variable can be disentangled from that of economic ones without necessitating use of computer or even calculators.

#### MDA

The Manual discriminant analysis (MDA) is a technique based on the rule of logic i.e. compare and contrast to study any phenomena. If we have an array of observations, then comparing the extreme observatins and contrasting them may help us understand

underlying rules which determine the distribution. Applying these rules to the observation between the extreme values one can confirm the validity of rules. The assumption is that the phenomena under study is distributed more or less continuously. The discontinuities can also be accommodated with some refinements in the method.